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A

GENERAL DESCRIPTION

OF THE

Bones

OF

THE SKELETON,

INTENDED FOR THE

USE OF STUDENTS.

BIBLIOTHECA·BODLEIANA

BY

HENRY KEMP RANDELL,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS.

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TO

RICHARD DUGALD GRAINGER, Esq.

DEAR SIR,

NEXT to the indulgence of the best feelings of my own heart, nothing has afforded me such unmingled satisfaction, as the kind intimation of your permission to allow me to dedicate the annexed elementary treatise on Osteology, to the name of Grainger!

The rise, and increasing reputation of the Webb Street School, has constituted a new æra in the history of Anatomical pursuits, and given a renewed impetus to the cultivation of the knowledge of the natural structure, and diversified functions of the organs of the human frame.

The stimulus thus excited by the example of your inestimable and deeply lamented brother, has not been lost upon the minds of the ardent and juvenile members of your numerous class. His memory is enshrined in indelible characters in their grateful recollections, and his name will be enrolled with honour in the future calendar of fame!

To *him* and *yourself*, I am proud to acknowledge, I owe all the information I possess upon a subject so interesting to the conscientious and intelligent Surgeon; and if under your fostering auspices, the present work shall obtain a favourable reception among the younger members of the profession, I shall consider my labour amply repaid, and with feelings of unfeigned gratitude and the highest respect, subscribe myself,

Dear Sir,

Your obliged Pupil,

Henry Kemp Randell.

PREFACE.

THE view which the author has entertained in sending the following pages to the press, has been to afford the student a concise and familiar guide to the study of Osteology.

An accurate acquaintance with the bones is as essential to the study of the ligaments, and the origins, insertions, and functions of muscles, as these are again, to the relative situation and course of the arteries; and indeed, correctly speaking, there is no part of the body in which this knowledge is not absolutely requisite. They form the basis or groundwork of all anatomical and surgical knowledge, and without an intimate acquaintance with them, no man can justly merit the appellation of Anatomist and Surgeon.

The author had at first intended to give a tabular arrangement of the important features of each individual bone, a course which is followed by all modern writers on anatomy; in certain parts it will be observed that he has adhered to this rule, but he has found from experience, that this does not always render the acquirement of particular bones so easy as it was perhaps intended, and therefore, he has preferred giving (more especially in the bones of the head) a minute and clear description of the different parts in the order that they present themselves to the eye: a rule which was followed in a great measure, by the late Edward Grainger, the notes of whose lectures have afforded no small share of assistance in the compilation of the work.

But while in the spirit of candour and truth he makes this acknowledgment to the memory of a superior anatomist, and highly gifted teacher, justice to himself compels him to add, that he has not been a mere copyist, but has ventured to incorporate original descriptions which his judgment has taught him to regard as more appropriate and distinctive. These conceptions he offers with great diffidence, and is only desirous that the work should rest upon its own merits.

He has endeavoured to render the description as clear and accurate as possible, and in a manner which he trusts will enable the student, by the assistance of the bones themselves, to obtain a complete knowledge of their peculiar characters.

To the student, about to attend the hospitals, he hopes that it will be highly useful, inasmuch as it may forward him considerably in the commencement of his dissections. And if on perusal it is found to be worthy of notice, he will be sufficiently recompensed, and led to hope that his exertions have not been ineffectual or useless.

Rotherhithe, Sept. 30th, 1828.

A GENERAL DESCRIPTION

OF THE

BONES.

OF THE SKELETON.

THERE are two kinds of skeletons, *viz.* the artificial and the natural. In the natural skeleton, the bones are connected together by the ligaments; but in the artificial, they are fastened to each other with wires, pieces of tin, &c. and by various mechanical contrivances. The latter is always used for describing the bones.

The skeleton consists of three grand divisions, *viz.* the head, trunk, and extremities.

As the bones of the head are generally considered the most difficult for the young student to acquire a knowledge of, we shall first describe the trunk, then will follow the bones of the extremities, and lastly those of the head.

The trunk is divided into three parts, *viz*. the spine, thorax, and pelvis.

The spine is formed of two pyramids, which meet at their bases. The upper pyramid is the longest, and is formed of twenty-four bones, and these are called true vertebræ. The lower pyramid in the adult is formed only of two bones, *viz*. the sacrum, and os coccygis. But in the young subject it is formed of nine portions; the sacrum being divided into five portions, and the os coccygis into four; and these are called false vertebræ.

On examining the spine in a perpendicular direction, we find that it has several alternate advances and recessions in its course downwards. Commencing at the atlas, or first bone of the spine, it will be found to advance throughout the greater part of the neck, till it reaches the top of the back.

This is to give support to the trachæa, œsophagus, and great vessels of the head and neck; and also to allow the muscles which lie close upon the fore part of the cervical column a greater power in bending the head forwards. Tracing its course downwards, it will be found to recede throughout the greater part of the back, in order to increase the space for the thoracic viscera. At the lower part of the back it again advances, and continues to do so throughout the greater part of the loins. This is to give support to the abdominal viscera. At the lower part of the loins it a second time recedes towards the sacrum, in order to allow the weight of the body to fall perpendicularly upon the base of the sacrum. The sacrum itself is concave, to increase the size of the pelvic cavity, and room for its contents. Lastly the lower extremity of the sacrum uniting with the os coccygis, advances to support the extremity of the rectum

The true vertebræ are divided into three classes, *viz.* the seven superior, called cervical; the twelve next, dorsal; and the low them, as in the dorsal vertebræ. Lastly, the foramen for the transmission of the spinal marrow, which is placed between the back part of the body and the arch, is triangular.

From this general description of the cervical vertebræ, there are some exceptions. These exceptions exist in the first, the second and the seventh.

The first vertebra, called the atlas, is merely a bony ring, having neither body nor spinous process. In the place of the spinous process there is a small tubercle. Upon the fore part of the ring, internally, a small articulating surface may be distinguished, which is connected with the processus dentatus of the second vertebra. The superior articulating processes are hollowed and face each other, in order to receive the convex condyloid processes of the occipital bone. The inferior articulating processes are nearly flat, and are placed horizontally, in order that the atlas may roll upon the dentatus. Upon the inner side of the superior articulating processes are two small prominences, called tubercles, giving attachment to the transverse ligament which crosses behind the processus dentatus, and confines it in its situation; and thus it divides the foramen of the atlas into two parts. The anterior part is occupied by the processus dentatus, and the posterior by the commencement of the spinal marrow: thus this ligament defends the spinal marrow from injury. Whenever from accident or disease it gives way, the head falls forwards, the spinal marrow is compressed, and instant death is the immediate result. The transverse processes are very strong, and are not bifid at their extremities, although they give attachment to some of the small oblique muscles of the head. Behind the superior articulating processes there is a groove which winds in a horizontal direction. It transmits the vertebral artery, after it has traversed the foramina of the transverse processes, which here makes a wide and sudden turn to get into the skull.

The next exceptions are in the dentatus, so named from its tooth-like process.

This process ascends perpendicularly, to be received into a small articulating cavity upon the forepart of the ring of the atlas internally; and has anteriorly a smooth surface, corresponding to that upon the atlas. It has a conical termination, and is as thick as the little finger. Inferiorly, near its root, it is somewhat contracted, and has upon its back part (in some subjects more or less distinct) a groove, which is occupied by the transverse ligament. At the top it is rather pointed, and here gives attachment to the perpendicular ligament, which passes to be inserted into the basilar process of the occipital bone. The superior articulating processes are nearly flat, in order that the inferior articulating processes of the atlas may roll round upon them, as the fore-part of a waggon does upon the fore carriage, only in the inverted direction, and the atlas, being threaded as it were by the dentiform process, rests upon the shoulders of the dentatus, and there turns and performs all the rotatory motions of the head. The transverse processes are short, but are not bifid. The spinous process is short, thick, and forked, and is turned somewhat downwards, so as not to interfere in any degree with the rotation of the atlas. The opening for the transmission of the spinal marrow is triangular.

The last exception in the cervical vertebræ is in the seventh.

The seventh cervical a good deal resembles the first dorsal, and particularly in the length of its spinous process, which is not bifid, but terminates in a tubercle or blunt point. The transverse processes are not bifid, and the foramen in them is but small, transmitting a vein from the spinal marrow, and not the vertebral artery.

Dorsal Vertebræ, or Second Class.

The dorsal vertebræ are larger than the cervical, and, on examination of the structure of their bodies, appear to be more spongy, but are surrounded by a firm case of bone externally. They are rounded or convex anteriorly, and are slightly hollowed behind. They are flat above and below. On each side of the body posteriorly, and at the upper part, we may observe a half articulating surface, and a similar half of one below, for connexion with the heads of the ribs. The articulating processes are placed perpendicularly, whilst, (let it be remembered) in the cervical they are placed obliquely; the two superior articulating processes face backwards, whilst the two inferior face forwards. The transverse processes are remarkably strong, and pass obliquely outwards and backwards; and upon the extremity of each process there is a small articulating surface for articulation with the tubercles of the ribs. The spinous processes descend obliquely downwards and backwards, and terminate in a tubercle or point. Upon the upper part of each spinous process there is a small ridge, or sharp edge, and inferiorly, there is a corresponding excavation; and when the spine is extended, this excavation inferiorly receives the ridge of the same process below it, and thus all lateral motion is completely prevented by the processes locking down, as it were, upon one another. The foramen for the transmission of the spinal marrow, in all the dorsal vertebræ, is nearly circular.

The exceptions to this general description of the dorsal vertebræ exist in the first, the tenth, eleventh, and twelfth.

In the first dorsal there is a whole articulating surface at the upper part, for connection with the whole of the head of the first rib: below it has half an articulating surface for half the head of the second rib. In the tenth dorsal there is half an articulating surface at the upper part, for half the head of the tenth rib, but no articulating surface inferiorly.

Upon the eleventh and twelfth dorsal vertebræ there are whole articulating surfaces, receiving the heads of their corresponding ribs. There are no articulating surfaces upon their transverse processes, because the two last ribs have no tubercles; so that the connection between the two last ribs and two last dorsal vertebræ, is only with their bodies, and not with their transverse processes.

Lumbar Vertebræ, or Third Class.

The bodies of the lumbar vertebræ completely resemble the dorsal, excepting that they are larger, and are more spongy in their internal structure; although surrounded by a firm osseous case externally. They are much rounded anteriorly, but posteriorly they are nearly flat. They are also flat above and below. The superior articulating processes are, like the dorsal, placed perpendicularly; and are hollowed, and face each other. The inferior are slightly convex, and face from each other. The transverse processes pass nearly horizontally outwards from the arch; they are long and slender, giving attachment to the abdominal muscles. The spinous processes, in the two first lumbar pass downwards and backwards, but in the three last they pass directly backwards, and terminate in a perpendicular obtuse edge. The foramen for the transmission of the spinal marrow is nearly triangular in the upper lumbar, whilst in the lower it is completely so, and transmits the lower portion of the spinal marrow, which here splits into numerous fibrilla, and forms what is called the cauda equina.

INTERVERTEBRAL SUBSTANCE.

The intervertebral substance is placed between two adjoining vertebræ. It appears to be intermediate between cartilage and ligament, and is commonly called a *ligamento cartilaginous* structure (though improperly, for it is neither ligament nor cartilage): internally, and in the centre, it is nearly semifluid, and is there but very little compressible. Anteriorly it appears to consist of elastic lamella, and adheres very firmly to the face of each vertebra, and is attached also very firmly to each by strong ligamentous matter. It increases in quantity as the vertebræ descend, though it is not strictly proportioned to the size of the vertebræ, being more abundant between the cervical, in proportion to their size, than between the lumbar. It possesses so much elasticity externally, that if the body be bent to one side, it immediately yields; but the moment the position is changed, it returns by a powerful resilition to its original dimensions. By its firm connection with the different vertebræ, the motions of the spine are rendered more secure. It is one of the wisest provisions in nature, for by its elasticity, all shocks in leaping, or from falls, are effectually prevented from injuring the spinal marrow, or producing luxation of the vertebral joints.

MOTIONS OF THE SPINE.

The motions of the spine are very considerable, but the degrees of motion vary with the forms of the different vertebræ in each part of the spine: it is most extensive in the neck, it is more limited in the loins, and in the back scarcely any exists. The head performes all the nodding motions upon the first vertebra of the neck (the atlas). The rotatory motion of the head is effected by the atlas rolling upon the dentatus. All the lower vertebra of the neck allow of flexion and extension, and of slight lateral motion; and by their assistance the nodding and rotatory motions of the head are much increased. In the dorsal vertebræ only flexion and extension are allowed, but in the lumbar, in addition to flexion and extension, slight lateral motion is permitted: so that there is a general twisting and bending of the whole spine. When the body is bent forwards, the weight falls upon the anterior part of the bodies of the vertebræ; but when extended backwards, the weight is principally thrown upon the back part of the bodies, and also upon the articulating processes. When it is bent laterally, it is partly thrown upon the one and partly upon the other.

The spine supports the head, neck, and upper extremities; in connection with the ribs it forms the thorax; and it furnishes a bony canal in its centre, lodging the spinal marrow.

BONES OF THE THORAX.

The thorax is composed of thirty-seven bones, *viz.* twelve dorsal vertebræ, (already yields; but the moment the position is changed, it returns by a powerful resilition to its original dimensions. By its firm connection with the different vertebræ, the motions of the spine are rendered more secure. It is one of the wisest provisions in nature, for by its elasticity, all shocks in leaping, or from falls, are effectually prevented from injuring the spinal marrow, or producing luxation of the vertebral joints.

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There are to this general description of the ribs, as in the vertebræ, certain exceptions. These exceptions will be found in the first, the eleventh, and the twelfth.

The first rib is remarkable for its thickness and strength, for its peculiar position (being placed nearly flat), and for its circular shape, forming nearly two thirds of an imperfect circle. It has no angle, and does not possess that contorted appearance which the rest of the ribs have in common, more or less. Upon its head there is an articulating surface, without any oblique ridge. Upon its flat upper surface there are two large grooves (sometimes hardly distinguishable), transmitting the subclavian artery and vein, just before it takes the name of axilary artery. The groove for the artery is placed nearest the shoulder. It has no groove on its under surface for the intercostal vessels. Upon the heads of the eleventh and twelfth ribs, there are also whole articulating surfaces, corresponding to those upon the two last dorsal vertebræ. They have no tubercles. The intercostal groove in the eleventh rib is nearly indistinct, and is quite so in the twelfth.

The cartilages of the ribs complete the form of the thorax, and form all the lunated edge of that cavity; and it is from this cartilaginous circle that the greater muscle of the diaphragm has its chief origin, forming the partition between the thorax and abdomen. They are connected to the anterior extremities of the ribs by imperfect joints, which are liable to luxations from falls or blows. They are implanted into the sternum by round sockets, which may be distinguished upon each side of that bone. The cartilages of the first and second rib descend to touch the sternum. The cartilage of the third rib is direct. Those of the fourth, fifth, sixth and seventh ribs rise upwards in proportion to their distance from this central one. The first five ribs have independent cartilages; the eighth, ninth, and tenth ribs, run their cartilages into the cartilage of the seventh rib. The eleventh and twelfth ribs have their cartilages small, unconnected, loose, and floating.

MOTIONS OF THE RIBS.

The extent of motion increases as the ribs descend. Thus the first rib is the most fixed, whilst the last true rib (the seventh) moves extensively. In inspiration the ribs ascend, and their under edges are thrown outwards; and thus the cavity of the thorax is considerably enlarged. In expiration they return to their former situation.

THE STERNUM.

The sternum completes the osseous cavity of the thorax anteriorly. It is spongy in its structure, and is divided into three portions; but the third portion is only ossified in old age, and is called the cartilago ensiformis vel xyphoides, from its supposed resemblance to a sword's point. In the young subject, it consists of eight pieces, and even in old age it is fairly divisible into three. This bone is placed in an arched direction from above, downwards. It is slightly convex upon the fore part, and slightly concave behind, and thus it corresponds to the shape of the ribs.

The first portion is cordiform in shape. Upon the upper and back part of it, is seen a notch or excavation, transmitting the trachæa as it enters the chest. Upon each side of this notch we find an articulating surface, receiving the sternal extremities of the clavicles. Between the ends of the clavicles and sternum there is an intermediate cartilage placed, called inter-articular, connecting them together. Below these surfaces for the clavicles we find a depression on each side, receiving the cartilage of the first rib, and a half of one below, receiving half the cartilage of the second rib. Inferiorly there is a rough surface, connecting it to the upper part of the second portion.

The second portion is about four or five inches in length. It has a rough surface superiorly, connecting it to the under part of the first portion; also at its lower part there is another surface, connecting it to the cartilago ensiformis. On each side of the bone are seen excavations receiving half the cartilage of the second rib, the whole of the third, fourth, fifth, sixth, and half the cartilage of the seventh rib.

The ensiform cartilage is about an inch and a half in length, and is rather of a triangular shape, sometimes the extremity is bifid, and in some persons it projects very much. Upon the upper part there is a rough surface connecting it to the under part of the second portion, and upon each side there is a small excavation, receiving half the cartilage of the seventh rib.

The motions of the sternum are entirely influenced by those of the ribs. In inspiration it advances, and in expiration it returns to its natural situation.

BONES OF THE PELVIS.

The pelvis in the adult is formed of four bones, *viz.* two ossa innominata upon the fore part and sides, and the sacrum and os coccygis, behind.

In childhood, and in the fœtus, the ossa innominata consist of three portions each. The sacrum also consists of five portions, and the os coccygis of four, as has been before mentioned. But in the adult, these divisions no longer exist, though the marks of their original separation generally remain more or less distinct.

The three portions of the os innominatum have received the following names.

The upper part is called the ileum; the lower and posterior part, the ischium; and the forepart the pubis. This division is always retained in describing the bones of the pelvis.

The ileum forms the upper and largest part of the haunch bone, and wing of the pelvis. Upon the upper part we find the crista or spine; this passes in an arched direction from before, backwards. It consists of two labia, to which the abdominal muscles are attached. The spine is bounded both anteriorly and posteriorly by two processes, *viz.* the anterior and superior spinous process, to which, the tensor, vaginæ, femoris, and sartorius muscles are attached; and also the iliac extremity of Poupart's ligament. Below is seen the anterior and inferior spinous process, to which, the short head of the rectus femoris is attached. Posteriorly, are seen the posterior spinous processes, superior and in-inferior, less distinct than the anterior, and to these, ligaments are attached, tying the the ileum to the sacrum, and to the last lumbar vertebra. The outer part of the ileum is called the dorsum, and upon this there are several elevations and depressions, giving attachment to the glutæus medius muscle. There is also an imperfect semicircular ridge, about two inches below the crista, which gives origin to the glutæus minimus. The internal part of the ileum is hollowed, and forms the venter or fossa iliaca, giving origin to the iliacus internus. The venter is bounded inferiorly by a line, which commences from the pubis. It forms the brim of the pelvis, and is called the linea ileo pectinea vel innominata. Below this line posteriorly, there are two large rough surfaces, the anterior of which unites the ileum with the sacrum, and to the posterior large masses of ligament are attached, firmly tying the bones together, and effectually preventing motion in that part. The lower and anterior portion of the ileum, forms the upper and outer part of the acetabulum. This is smooth internally, for connection with the head of the os femoris; and rough externally, being marked by the attachment of the capsular ligament of the hip joint. Posteriorly, between the lower part of the bone and the posterior, inferior spinous process, there is an excavation, which, when the bone is united with the ischium, assists in forming a large portion of the sacro ischiatic vel sciatic notch. Upon the inner part of the bone, just above the linea ileo pectinæa there are several holes, transmitting arteries to nourish the interior of the bone. There are also similar holes upon the dorsum for the same purpose.

ISCHIUM, OR SECOND PORTION.

The ischium is placed perpendicularly under the ileum, and is the lowest point of the pelvis upon which we sit. The upper part of it forms the lower and largest part of the acetabulum. This is smooth interternally where it is connected with the head of the os femoris, and it is marked by the attachment of the capsular ligament externally. On a level with the lower part of the acetabulum, we find the spinous process, projecting backwards and inwards, and to it the superior sacro sciatic ligament is attached. Below this process the bone becomes expanded, and forms the tuber ischii; and upon the back part of the tuberosity, the inferior sacro sciatic ligament is inserted. The tuberosity is broader posteriorly than anteriorly. To the broadest part, the semimembranosus, semitendinosus, and biceps flexor cruris muscles are attached. In the sitting posture, the body rests upon the narrow and anterior part of the tuberosity. Between it and the spinous process there is a groove, through which the obturator internus muscle leaves the pelvis, and the internal pudic blood-vessels and nerves re-enter the pelvis. Between the tuberosity and acetabulum there is a second groove through which the tendon of the obturator externus muscle passes to its insertion. From the tuberosity the ramus or crus proceeds, and ascends upwards and inwards, to meet the crus or descending ramus of the pubis. The inferior edge of the crus is rough, giving attachment to the crus penis. The superior edge is thin, where it forms a part of the foramen ovale vel thyroideum.

Upon examining the internal part of the tuberosity an imperfect groove is seen, which continues its course along the inner side of the ramus of the bone, and transmits the internal pudic artery. Whenever this vessel is wounded in the operation of lithotomy, a fatal hæmorrage is always liable to ensue; and it can only be restrained, by making firm and uninterrupted pressure for some hours with the forefinger, a little padded. The finger must be passed through the wound in perinæo, and firmly pressed upon the vessel where it lies in close contact with the bone in the groove just described. The surgeon to whose care the patient is committed, should be frequently relieved by an able assistant.

THE PUBIS, OR THIRD PORTION,

Is the smallest of the three, and forms the most anterior part of the haunch bone. Upon the inner and forepart, there is a rough surface, which is connected to a ligamento cartilaginous structure, intervening between the ossa pubes, and connecting them together, forming what is called the symphisis pubis. Nearly an inch to the outer side of the symphisis, there is a tubercle, to which the pubic portion of Poupart's ligament is attached. The most external part of the bone forms the most internal part of the acetabulum, which, like the two other portions of the os innominatum, is smooth internally for connection with the head of the os femoris, and rough externally, being marked by the attachment of the capsular ligament. That portion intervening between the tubercle and acetabulum, is called the body, which is slightly excavated and smooth, for the transmission of the femoral vessels and nerves, the artery being placed most externally. Upon the under part of the body of the bone there is a notch, which, when united with the ischium, forms the foramen ovale. This, in the recent subject, is completely filled up with a ligament, called the obturator, which has a small opening at its upper part for the transmission of the obturator, blood-vessels, and nerve. From the tubercle, the linea ileo pectinea commences, and, uniting with the ileum, it passes backwards as far as the sacro iliac symphisis, forming the brim of the pelvis. To the commencement of this line, Gimbernat's ligament is attached. From the under part of the symphisis, the ramus or crus commences, running downwards, outwards, and backwards, to unite with the ascending ramus of the ischium.

OS SACRUM.

Is triangular in shape, being expanded above, and contracted below. Its anterior surface is tolerably smooth and concave. This concavity increases the room for the pelvic viscera, and favours the descent of the head of the child in parturition. The back part has been described as being irregularly convex and rough. There is a solid portion of bone running down the centre, which forms the body. Upon this anteriorly, are seen four transverse lines, which indicate the points of separation in the young subject. The top of the body projects very much forwards, forming what is called the promontory or base; though, strictly speaking, this is more completely formed by the junction of the bone with the last lumbar vertebra. The promontory is flattened, to allow the last lumbar to lay flat upon upon it. Behind the base there are two articulating processes; these face a little towards each other, and receive the inferior articulating processes of the last lumbar vertebra. On each side of the base, there are two large transverse processes, called the alæ, or wings of the bone; and upon each of these is seen an extensive surface, by which the bone is joined to the ileum, forming the sacro iliac symphisis. Posteriorly to this junction ligaments are attached, firmly tying the bones together; and these are called the sacro iliac ligaments. Below the alæ on each side, are two abrupt projections of the bone, called tubercles, giving attachment to the sacro ischiatic ligaments. On the forepart of the bone, and on each side of the body, are seen four foramina, and below the last foramen, on each side, there is a distinct notch or excavation, which, when the bone is joined to the os coccygis, is completed into a foramen, by means of a ligament. The three upper foramina, on each side, are the larger, and transmit nerves, which chiefly form the great sciatic. The two smaller only give passage to nerves, ramifying about the rectum and parts in the neighbourhood. Running down the centre of the bone posteriorly, is seen the spine. This sometimes terminates in a projecting point, or most commonly in a bifid extremity. Occasionally the spine of the sacrum is wanting. There are four pairs of foramina on the back part, which correspond to those in front. These in the recent subject, are nearly filled up with ligament, merely transmitting small nerves and blood-vessels, and thus rendering the bone lighter. Upon the lower part of the bone there is an oblong process, covered with an imperfect articulating surface, by which it is received into a hollow, in the upper part of the os coccygis. The opening for the transmission of the spinal marrow, or canda equina, as it is here more properly called, is triangular.

OS COCCYGIS,

(So named from its resemblance to a Cuckoo's bill).

This bone is, like the sacrum, triangular in shape, although much curved anteriorly. The base of the triangle is above, and it contracts to a point inferiorly. Superiorly there is an excavation, receiving the lower end of the sacrum. Upon the sides, and upper part, are seen two transverse processes, for the attachment of ligaments, completing the notches on each side of the sacrum, inferiorly, into two foramina. In the centre, are three transverse lines, which mark its original division into four pieces. This bone supports the extremity of the rectum, and is said to prevent rupture of the perinæum during parturition.

FORMATION OF THE ACETABULUM.

This cotyloid, or cup-like cavity, is formed by three bones, already described, *viz.* the ileum, ischium, and pubis. But as they do not enter into its formation in equal proportions, one forming more and another less, it is usual, for the better description, to divide it into fifths; and it is then found, that the ileum forms two fifths, the ischium rather more than two fifths, and the pubis scarcely one fifth. This cavity is deepest at its upper and outer part, or, more precisely speaking, posteriorly and inferiorly to the anterior and inferior spinous process of the ileum. It is most superficial just above the foramen ovale, and at this part the bony edge is deficient, forming a notch, which is completed into a foramen by means of the transverse ligament. Through this foramen the vessels nourishing the joint and head of the bone enter.

Foramen ovale vel thyroideum is formed by the ischium and pubis. In the recent subject it is almost entirely filled up with a ligament, called the obturator, except at the upper part, where an opening is almost invariably left for the transmission of the obturator, blood-vessels, and nerve. Its principal use seems to be to lighten the pelvis, and to allow the soft parts to recede a little from pressure during the passage of the head of the child.

THE SACRO SCIATIC, OR ISCHIATIC NOTCH,

Is formed of the ileum, ischium, and sacrum; and occasionally the os coccygis assists. By the addition of the sacro ischiatic ligaments, this notch is formed into two foramina, an upper and a lower. The upper is the largest, and through it the pyriformis muscle leaves the pelvis, and above it, the glutæal artery and vein, and superior glutæal nerve. Below the muscle the inferior glutæal nerve, the ischiatic artery, vein, and nerve, and the internal pudic artery, vein, and nerve. Through the lower opening, the tendon of the obturator internus muscle quits the pelvis; and the internal pudic blood-vessels and nerve re-enter the pelvis.

The bones of the pelvis having been described, we now come to speak of its divisions.

The pelvis is divided into two spaces, an upper and a lower, by means of the brim, which is formed on each side by the linea ileo pectinæa, or linea innominata; and posteriorly, by the base of the sacrum. This line supports the impregnated womb. The upper space is occupied by muscles and the intestines; the lower by the bladder and rectum, and in the female by the unimpregnated uterus and vagina.

The marks of difference between the male and female pelvis are the following:

The male pelvis, though large, firmly ossified, and consequently very strong, has very narrow openings. The bones are much stronger than those of the female and the alæ of the ilea are nearly erect; whilst in the female they are widely expanded, and are so thin, as to be in the centre, almost semi-transparent, and thus increasing too, the size of the pelvic cavity. The acetabula are much more closely approximated in the male than in the female, and the thighs, being thus in a direct line with the body, the step is rendered graceful and firm. In the male the shoulders are broad and the haunches small, but very strong. In the female the shoulders are narrow, but graceful and round, the haunches are broad, the thighs round and large. The acetabula are much more widely separated, the knees are thus caused to approach each other, and the step is rendered unsure. Women of the most beautiful form walk with a delicacy and feebleness which we acknowledge as a beauty in the weaker sex. But the chief marks of distinction between the two pelves are in the form of the sacrum and size of the outlet.

The sacrum of the female compared with the male, is very nearly straight, and is much wider, whilst in the male it is considerably curved.

The tuberosities of the ischia in the female are much more widely separated, and the arch of the pubis, considerably expanded, thus the size of the inferior aperture is increased.

Although there are four points of junction in the pelvis, *viz.* the sacro iliac symphisis on each side, the symphisis pubis, and the sacro coccygeal joint, yet properly speaking, there is but one articulation, which is the last mentioned. The others in the male are frequently anchylosed, and even in the female there is only a slight yielding at the symphisis pubis, and a corresponding one at the sacro iliac symphisis. In the sacro coccygeal articulation, however, there is motion backwards and forwards, and thus during parturition the outlet of the pelvis, by the recession of the coccyx, will be increased posteriorly to the extent of an inch.

The pelvis supports the spine, and moves very extensively upon the heads of the femurs.

BONES OF THE EXTREMITIES.

DESCRIPTION OF THE BONES OF THE UPPER EXTREMITY.

The upper extremity is divided into the shoulder, upper arm, fore arm, and hand.

The bones of the shoulder are two in number, *viz.* the clavicle and scapula.

THE CLAVICLE

Is placed upon the upper part of the chest, extending from the sternum horizontally outwards to the top of the shoulder. The sternal end is triangular in shape; the base of the triangle being placed above, and the apex below. To the apex a ligament is attached, which crosses behind the first portion of the sternum, to the apex of the opposite clavicle, tying them to each other; this is called the inter-clavicular ligament. Upon the sternal extremity there is an articulating surface, which receives a cartilage intervening between it and the first portion of the sternum, the use of which is to facilitate the motions at that part. Upon the under part of the sternal end there is a rough surface, which gives origin to a ligament, tying the bone down to the first rib. The body of the clavicle arches forwards and then backwards, being shaped like an italic *ſ*. The sternal portion of the body is round, whilst the scapular, or outer portion, becomes expanded. Upon the scapular end, posteriorly, there is a small flattened surface, by which, with the addition of a small cartilage, it is articulated to the inner side of the acromion process of the scapula. Upon the under part of the scapular extremity there is a rough surface, giving attachment to a ligament, tying it to the coracoid process of the scapula. Upon the back part of the bone, near the shoulder, we find one or two foramina, transmitting the nutrient arteries of the bone. The clavicle moves upwards and downwards, backwards and forwards, according to the motions of the shoulder; and by its throwing the scapula to one side, it considerably increases the motion of the arm. It is the only connection, by means of bone, of the upper extremity with the trunk.

THE SCAPULA, OR BLADE BONE,

Is a thin bone resting upon muscle, and connected to the trunk solely by means of the clavicle. It is situated obliquely, upon the back part and sides of the chest, extending from the second rib to the seventh. It is triangular in shape; the base being formed by the upper part of the bone, and the apex by the lower part. It has three costæ or edges, *viz.* the superior, or shortest, which is placed above; the inferior costa is placed anteriorly; the posterior, which is the longest of the three, is called the base. It has also three angles; a superior, anterior, and inferior. The superior angle is placed between the superior costa and upper part of the base; the inferior between the lower part of the base and inferior costa, and the anterior between the superior costa and upper part of the inferior costa. This angle is covered by the glenoid cavity. The outer part of the bone is called the dorsum, and is divided into two unequal spaces, or fossa spinati, by means of the spine. The upper, which is the smaller, is called the fossa supra spinata, and gives origin to the supra spinatus muscle; the lower, the largest, is called fossa infra spinata, and gives origin to the infra spinatus muscle. The spine commences from the posterior costa or base; it passes obliquely upwards and forwards, and becoming expanded anteriorly, it forms the acromion process. Upon the inner side of this process a small convex articulating surface is seen, by which it is articulated to the scapular extremity of the clavicle. The whole of the spine is rough, receiving the insertion of the trapezius, and also giving origin to the deltoid muscles.

Upon the anterior angle is seen, (as has been stated), the glenoid cavity. This cavity is of an oval shape and is very shallow, but it is deepened by a cartilage. It is covered with an articulating surface for connexion with the head of the humerus. This surface is narrow above, but broad below, but is not near so extensive as that found upon the head of the humerus. Around the edge of this cavity there is a rough edge, marked by the origin of the capsular ligament. At the upper part of it there is a small projection, which has received the name of tubercle. It gives origin to the tendon of the long head of the biceps muscle. That part of the bone behind the glenoid cavity is contracted, and forms the cervix scapulæ. From the inner and upper portion of the cervix, the coracoid process projects, passing nearly horizontally forwards, and, at its extremity it becomes curved a little downwards, to give origin to the short head of the biceps and corico brachialis muscles. To the inner side of the glenoid cavity, between the root of the coracoid process and superior costa, is seen the notch of the scapula. This, in the recent subject, by means of the posterior ligament of the scapula, is completed into a foramen, transmitting the superior dorsal artery of the scapula, its accompanying vein and nerve. Very frequently, however, the artery passes over the ligament, instead of going under it. The internal part of the bone, called the venter, is irregularly concave, and has several rough lines passing obliquely across it, which give origin to the fibres of the subscapularis muscle. Its base internally receives the insertion of the serratus major anticus, and externally the rhomboidei—its superior angle, the levator scapulæ; its inferior, a slip, occasionally of the latissimus dorsi. It also gives origin to the teres, major and minor muscles. The scapula moves upwards and downwards, also backwards and forwards, and it may be a little rotated; and thus the motions of the arm are increased. The motions between the scapula and clavicle are very much confined; indeed this may be considered as a fixed point, the clavicle serving as a shaft, or axis, and its principal motions being performed at its junction with the sternum.

OS HUMERI VEL OS BRACHII,

Is one of the truest cylindrical bones. The upper part of it is expanded, and forms the head. Upon this is seen an extensive articulating surface, which is received into the glenoid cavity of the scapula. Below the head there are two tubercles, a greater and a lesser. The greater is placed upon the outer part of the bone, and is rather inclined posteriorly; the lesser is placed more anteriorly. Upon the greater tubercle three surfaces are generally enumerated (in some bones more distinct than in others), receiving the insertions of the supra spinatus, infra spinatus, and teres minor muscles. Upon the lesser tubercle there is but one surface, receiving the insertion of the subscapularis. That part of the bone between the head and the tubercles is somewhat contracted, and forms the anatomical cervix. What is meant by the surgical neck, is that part between the tubercles and the commencement of the shaft. The anatomical neck is rough, for the attachment of the capsular ligament of the joint. Between the two tubercles the bicepital groove is placed, which transmits the tendon of the long head of the biceps muscle, in its course downwards, to join the second head, arising from the coracoid process of the scapula. This groove is bounded on either side by two ridges. Into the outer of these ridges the pectoralis major is inserted; into the inner, the latissimus dorsi and teres major, or the muscles which form the boundaries of the axilla. The shaft of the bone is twisted, and it becomes expanded inferiorly, terminating in two projecting processes, called its condyles (external and internal). Upon the middle and outer part of the bone there is a rough surface, which receives the insertion of the the deltoid muscle. Opposite to this, on the inner side, is seen the foramen, which transmits the nutrient artery. Proceeding upwards from the condyles, are seen two ascending oblique ridges, which form points of attachment for the inter-muscular ligaments. The external ridge and condyle also gives origin to the supinator radii longus and extensor muscles of the fore arm; whilst the internal ridge and condyle give origin to the pronator radii teres and flexor muscles of the fore arm. Of the two condyles, the internal is much the largest, and has a projecting process; and behind this is seen a groove, transmitting the ulnar nerve. Upon the condyles inferiorly, there are two distinct articulating surfaces. The internal of these is by far the most extensive, and forms a complete trochlear or hinge in connection with the ulna. The external is convex, and forms a ball, which is received into a socket upon the head of the radius. Above the condyles there are two excavations (cavities), one before and the other behind. The one in front is the smallest, and receives the coronoid process of the ulna in flexion of the fore arm, the other behind is much larger, and receives the olecranon of the ulna, in extension of the fore arm.

FORMATION OF THE SHOULDER JOINT.

The shoulder joint is formed by two bones, *viz.* the scapula and os humeri. In consequence of the shallowness of the glenoid cavity, and the extensive articulating surface formed upon the head of the humerus, motion is effected in every direction, either upwards and downwards, backwards and forwards, or outwards and inwards; and it may also be rotated in every direction. The motions which it performs are free, quick, and easy, but the joint itself is too superficial to be strong, and were it not for the scapula sliding easily upon the muscles, covering the ribs, and thus eluding force, it would be in danger of being seriously injured from slight shocks or falls. It is however not altogether unprotected. Nature has performed her part in endeavouring to screen it from injury, by supplying two strong processes, *viz.* the acronnon and coracoid; and she has additionally strengthened it by strong tendons, muscles, and ligaments.

BONES OF THE FORE ARM,

Are two in number, *viz.* the radius, passing down upon the outer side, and the ulna upon the inner.

The Ulna,

So named from its being often used as a measure, is the longer of the two. It is much expanded at the upper part, and considerably contracted below. It is lengthened at its upper and back part by the olecranon process, which receives the insertion of the triceps extensor cubiti muscle, and partially that of the anconœus. On the fore part of the bone, about an inch below this process, we find another, called the coronoid process; and this receives the insertion of the brachialis internus. The cavity placed between these two processes is called from its resemblance in profile to the letter *s* the greater sigmoid cavity of the ulna, to distinguish it from a smaller one. This cavity is covered with an articulating surface for connection with the internal condyle of the humerus, which it embraces so closely that it allows not the smallest degree of lateral motion. On the radial side of the bone, below this cavity, is seen the lesser sigmoid cavity of the ulna, and this allows the head of the radius to roll upon it in the rotatory motions of the arm. On the back part, below the olecranon process, there is a smooth and somewhat triangular portion of bone, which is merely covered with the fascia, and common integuments. On the fore-part of the bone, below the coronoid process, there is a small projection, which gives attachment to the oblique ligament, tying the ulna to the radius. The body or shaft of the bone is triangular, and as it descends it becomes gradually narrower, and then, at its lower extremity it again expands a little, to form its head, which is articulated by means of cartilage to the carpus. The inner part of the shaft of the bone is perfectly smooth and convex, but on the radial side there is a sharp ridge, to which one side of the inter-osseous ligament is attached. The lower end of the head has a flat surface, by which it is joined to the saxiform cartilage, which intervenes between it and the os cuneiforme; and thus it is that the ulna is excluded from the wrist joint. On the radial side of the head, there is a convex articulating surface, which is received into the sigmoid cavity of the radius, whilst on the inner side is seen the stiloid process, which gives origin to the internal lateral ligament of the carpus. On the fore-part of the lower end of the bone there is a flat surface, extending upwards about two inches, which gives origin to the pronator radii quadratus muscle. On the back part there is a distinct groove, situated just between the origin of the stiloid process and that part which is received into the sigmoid cavity of the radius, which transmits the tendon of the flexor carpi ulnaris. The foramen for the entrance of the nutritious artery is placed upon the fore-part of the bone, about one third down.

THE RADIUS.

So named from its resemblance to the ray, or spoke of a wheel, is placed upon the outer side of the fore-arm. It is unlike the ulna, being contracted above, and expanded below. The top of the bone is called its head, which is quite round, and upon it there is a concave articulating surface, receiving the external condyle of the humerus. On the ulna side there is a convex articulating surface, which is received into the lesser sigmoid cavity of the ulna. About an inch below the head, and inclined to the inner and back part, is seen the tubercle, which gives insertion to the biceps muscle and capsular ligament. That part of the bone between the head and the tubercle is contracted, and forms the cervix, and to it the coronary ligament is attached. The body or shaft of the bone is triangular, but it is not as distinctly defined as that of the ulna. As it descends it increases in size, and inferiorly it becomes very much expanded, to be articu to the carpus. The outer part c

shaft of the bone is generally smooth and convex, but on the inner side there is a sharp ridge, corresponding to that of the ulna, to which the interosseus ligament is attached. Upon the lower extremity of the bone are seen two articulating surfaces, which are connected to the two first bones of the carpus, viz. the scaphoid and lunar. On the ulna side of the lower end, there is an articulating surface which is a little excavated, and is called the sigmoid cavity of the radius. It receives the head of the ulna. From the outer side of the lower end the stiloid process projects, giving origin to the external lateral ligament of the carpus. Upon the fore-part of the lower end there is a somewhat flattened surface, receiving the insertion of the pronator radii quadratus. On the back part of the lower extremity there are several grooves, transmitting the tendons of the extensor muscles. The opening for the principal nutritious artery is placed upon the fore-part of the bone, generally a little more than one third down.

FORMATION OF THE ELBOW JOINT.

The elbow joint is formed by the condyles of the humerus and upper extremities of the radius and ulna. Between the ulna and internal condyle there is a perfect trochlear, admitting of flexion and extension. Between the radius and external condyle there is a ball and socket joint; but still the radius moves backwards and forwards with the ulna in flexion and extension: and if the arm be ever so much bent, yet the head of the radius will rotate upon the external condyle. So that the joint between the head of the radius and external condyle admits not only of flexion and extension, but also of rotatory motion.

There are two joints between the radius and ulna, independent of the elbow or wrist joint. In the superior of the two we find that the round head of the radius rolls upon the lesser sigmoid cavity of the ulna. Inferiorly, the expanded extremity of the radius rolls upon the small head of the ulna, or, in other words, the small head of the ulna is received into the sigmoid cavity

of the radius. From this it will appear that the ulna is a fixed point; and it is by the radius rolling upon it, both at its upper and lower extremities, that the supination and pronation of the hand are effected.

BONES OF THE HAND.

The hand is divided into the carpus, or upper portion; meta-carpus, or middle portion; and the fingers, or third portion, placed inferiorly.

In describing the carpal bones, we shall first mention their most important processes and peculiarities; secondly, their relative situation; and, thirdly, recapitulate their various connections with each other.

THE CARPUS,

Consists of eight bones, which are arranged in two rows, *vis.*

os scaphoides,
— lunare,
— cuneiforme,
— pisiforme,

os trapezium,
— trapezoides,
— magnum,
— unciforme.

These eight bones are very firmly tied together by numerous bands of ligaments, making a sort of ball or nucleus, a solid foundation or centre for the rest of the hand.

The metacarpus is formed of five long bones, which are articulated to the carpal. Properly speaking, however, there are but four, the thumb being described by most anatomists as having no metacarpal bone, but the same number of phalanges as the fingers. What used to be described as the metacarpal bone is now considered as the first phalanx. The metacarpal bones departing from the carpal in somewhat of a radiated form, give a firm support to each individual finger. Indeed, the carpal and metacarpal bones, considered together, resemble a part of a wheel. The carpal bones are so closely grouped together, that they may be said to form the nave; and the metacarpal bones, diverging from the centre, form the spokes. Now a great advantage arises from their being placed in this radiated form, for not only are the fingers allowed to play more freely, but a by which it is joined to the saxiform cartilage, which intervenes between it and the os cuneiforme; and thus it is that the ulna is excluded from the wrist-joint. On the radial side of the head, there is a convex articulating surface, which is received into the sigmoid cavity of the radius, whilst on the inner side is seen the stiloid process, which gives origin to the internal lateral ligament of the carpus. On the fore-part of the lower end of the bone there is a flat surface, extending upwards about two inches, which gives origin to the pronator radii quadratus muscle. On the back part there is a distinct groove, situated just between the origin of the stiloid process and that part which is received into the sigmoid cavity of the radius, which transmits the tendon of the flexor carpi ulnaris. The foramen for the entrance of the nutritious artery is placed upon the fore-part of the bone, about one third down.

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shaft of the bone is generally smooth and convex, but on the inner side there is a sharp ridge, corresponding to that of the ulna, to which the interosseus ligament is attached. Upon the lower extremity of the bone are seen two articulating surfaces, which are connected to the two first bones of the carpus, viz. the scaphoid and lunar. On the ulna side of the lower end, there is an articulating surface which is a little excavated, and is called the sigmoid cavity of the radius. It receives the head of the ulna. From the outer side of the lower end the stiloid process projects, giving origin to the external lateral ligament of the carpus. Upon the fore-part of the lower end there is a somewhat flattened surface, receiving the insertion of the pronator radii quadratus. On the back part of the lower extremity there are several grooves, transmitting the tendons of the extensor muscles. The opening for the principal nutritious artery is placed upon the fore-part of the bone, generally a little more than one third down.

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os lunare, above it is connected to the saxiform cartilage, in front it supports the pisiform, and inferiorly it joins the os unciforme.

4. *Os pisiforme.*

So named from its resemblance to a pea, is placed upon the inner side of the palm, resting upon the os cuneiforme, and is the most prominent of all the lower bones. It forms one pillar of that arch under which the flexor tendons pass into the hand, the arch being formed by the anterior annular ligament of the carpus, which, arising from the scaphoid and trapezium, is inserted into the pisiform bone. This little bone stands somewhat out of its rank, and projects so much, that it may be readily felt. It receives the insertion of the flexor carpi ulnaris, one of the chief muscles flexing the carpus.

Description of the Second Row, and their Connexions.

The first bone of the second row, is called

5. *Os trapezium,*

From its name we might suppose that it was of a square shape, while in fact it is the most irregular of all the carpal bones, especially when detached from the other bones. It is placed below the scaphoid, but upon its radial side. Upon the fore-part there is a rough projecting process, which receives the insertion of the external lateral ligament of the wrist joint. Inferiorly there is a smooth surface, supporting the metacarpal bone of the thumb, and it also supports in part that of the fore-finger. — Connexions: Above, it is connected to the scaphoid; on its inner side, to the trapezoides; below, to the thumb, and in part to the fore-finger. It forms a double ginglymoid joint with the metacarpal bone, or first phalanx of the thumb.

6. *Os trapezoides.*

So named from its supposed resemblance to the trapezium, but improperly, for it much better resembles the cuneiform bone of the first row, being broad behind and narrow before; and also in its situation, being wedged in between the trapezium and the magnum. — Connexions: Superiorly, it joins the scaphoid; on the by which it is joined to the saxiform cartilage, which intervenes between it and the os cuneiforme; and thus it is that the ulna is excluded from the wrist-joint. On the radial side of the head, there is a convex articulating surface, which is received into the sigmoid cavity of the radius, whilst on the inner side is seen the stiloid process, which gives origin to the internal lateral ligament of the carpus. On the fore-part of the lower end of the bone there is a flat surface, extending upwards about two inches, which gives origin to the pronator radii quadratus muscle. On the back part there is a distinct groove, situated just between the origin of the stiloid process and that part which is received into the sigmoid cavity of the radius, which transmits the tendon of the flexor carpi ulnaris. The foramen for the entrance of the nutritious artery is placed upon the fore-part of the bone, about one third down.

THE RADIUS.

So named from its resemblance to the ray, or spoke of a wheel, is placed upon the outer side of the fore-arm. It is unlike the ulna, being contracted above, and expanded below. The top of the bone is called its head, which is quite round, and upon it there is a concave articulating surface, receiving the external condyle of the humerus. On the ulna side there is a convex articulating surface, which is received into the lesser sigmoid cavity of the ulna. About an inch below the head, and inclined to the inner and back part, is seen the tubercle, which gives insertion to the biceps muscle and capsular ligament. That part of the bone between the head and the tubercle is contracted, and forms the cervix, and to it the coronary ligament is attached. The body or shaft of the bone is triangular, but it is not as distinctly defined as that of the ulna. As it descends it increases in size, and inferiorly it becomes very much expanded, to be articulated to the carpus. The outer part of the

shaft of the bone is generally smooth and convex, but on the inner side there is a sharp ridge, corresponding to that of the ulna, to which the interosseus ligament is attached. Upon the lower extremity of the bone are seen two articulating surfaces, which are connected to the two first bones of the carpus, viz. the scaphoid and lunar. On the ulna side of the lower end, there is an articulating surface which is a little excavated, and is called the sigmoid cavity of the radius. It receives the head of the ulna. From the outer side of the lower end the stiloid process projects, giving origin to the external lateral ligament of the carpus. Upon the fore-part of the lower end there is a somewhat flattened surface, receiving the insertion of the pronator radii quadratus. On the back part of the lower extremity there are several grooves, transmitting the tendons of the extensor muscles. The opening for the principal nutritious artery is placed upon the fore-part of the bone, generally a little more than one third down.

FORMATION OF THE ELBOW JOINT.

The elbow joint is formed by the condyles of the humerus and upper extremities of the radius and ulna. Between the ulna and internal condyle there is a perfect trochlear, admitting of flexion and extension. Between the radius and external condyle there is a ball and socket joint; but still the radius moves backwards and forwards with the ulna in flexion and extension: and if the arm be ever so much bent, yet the head of the radius will rotate upon the external condyle. So that the joint between the head of the radius and external condyle admits not only of flexion and extension, but also of rotatory motion.

There are two joints between the radius and ulna, independent of the elbow or wrist joint. In the superior of the two we find that the round head of the radius rolls upon the lesser sigmoid cavity of the ulna. Inferiorly, the expanded extremity of the radius rolls upon the small head of the ulna, or, in other words, the small head of the ulna is received into the sigmoid cavity

of the fingers is restrained. These projecting processes form guides in amputating the fingers at the joints, and without the surgeon was aware of the extent to which they overlap the head of the phalanx above them, he would be completely foiled in his attempts to complete an operation, which is otherwise, with the knowledge of this fact, rendered the most simple in its nature, and the most easy in its performance. The extremities of the last row of phalanges are of a spongy structure, and are much expanded, to give form and beauty to the hand.

In the adult hand we generally find two ossa sessamoidæa, one placed at the root of the thumb, and another at the root of the little finger; but generally speaking, they are formed in parts which are much exposed to pressure. Thus they are frequently found in the foot, and more particularly at the ball of the great and little toes, and also at the os cuboides, parts which are necessarily and constantly exposed to pressure.

DESCRIPTION OF THE BONES OF THE LOWER EXTREMITY.

The lower extremity is divided into the thigh, leg, and foot.

The thigh consists but of one bone, *viz.* the os femoris.

The leg consists of three bones, *viz.* the patella, the tibia, and the fibula.

The foot, like the hand, is divided into three parts, *viz.* the tarsus, metatarsus, and the toes.

OS FEMORIS

Is the largest and strongest bone in the body, and is the most regular of all the cylindrical bones. The upper part, which is nearly spherical, is called the head. This is covered with a very extensive articulating surface, corresponding with that upon the acetabulum. This surface forms nearly two-thirds of a sphere. Inclined a little to the inner side of the centre, is seen an excavation, or pit, into which the ligamentum teres is inserted, tying the head of the bone to the acetabulum. From the head the cervix commences, and passes obliquely downwards and outwards. It receives almost at all times the whole weight of the body; and were it not for the oblique direction which it takes, it would perhaps be much more subject to fracture than it is. The articulating surface upon the head, it will be observed, is most extensive at the upper part, and where the acetabulum is deepest. It is exceedingly rough, and has numerous small foramina, especially at the upper part, being marked by the attachment of the synovial membrane, and capsular ligament of the joint. The small holes just mentioned, transmit small vessels, nourishing the head of the bone. Many fibres of the capsular ligament also pass into these holes, in order to obtain a firmer hold. The cervix is about two inches in length, and its name is more correctly applied to this bone than to any other in the body. It stands off almost at right angles with the body of the bone, and thus the motions of the limb are kept free and wide, and unembarrassed by the pelvis. At its termination we find a large process, called the trochanter major. This is placed a little below the level of the head of the bone. It receives the insertion of the glutæus, medius, and minimus muscles. At the root of this process there is a small pit or depression, into which the five rotator muscles of the thigh are inserted, *viz.* the gemini, the obturator externus and internus, and the pyriformis. On the inner and back part of the bone, rather more than two inches below the great trochanter, is seen the trochanter minor, and into this, psoas magnus, and iliacus internus muscles are inserted. Upon the back part of the bone, between the two trochanters, is seen an oblique ridge, receiving the insertion of the quadratus femoris. There is another ridge also in front (in some subjects more distinct than in others), marking the extent to which the capsular ligament is inserted. The shaft of the bone is nearly cylindrical, and is much contracted; as it descends it becomes arched or curved forwards. The body of the bone is smooth and convex anteriorly, and is here covered by muscles, whilst posteriorly it has a sharp edge, called the linea aspera. This edge or rough line commences at the upper part of the bone by two lines, one proceeding from the trochanter major, and the other from the minor. These unite and form one, which passes directly downwards, upon the centre of the body, and when it has descended as far as the commencement of the lower third of the thigh, it again separates into two lines, one passing to either condyle. Into the commencement of this rough edge the glutæus maximus is inserted. Inferiorly, the bone very much expands, and forms the two condyles (external and internal), of which the internal is much the larger, and has a projecting kind of process, upon which the adductor magnus, or third head of the triceps femoris, is inserted. Above the condyles the bone is rough and porous, being marked by the attachment of the capsular ligament of the knee joint. Between the condyles anteriorly, there is an articulating surface, forming a complete trochlear, or pulley; and in this pulley the patella is received. Between the condyles posteriorly, a notch is observed, which gives origin to the crucial ligaments, and also receives a bifid tubercle, which stands upon the head of the tibia. The condyles inferiorly are covered with two very extensive articulating surfaces, for connexion with the head of the tibia. These surfaces ascend very much upon the condyles posteriorly, and thus it is that we are enabled completely to bend the leg upon the thigh. Above the condyles, posteriorly, there is a triangular and smooth portion of bone, which is called the poples, or ham, lodging the popliteal artery, vein, and nerve; the artery being placed nearest to the bone. This space is accurately bounded on each side by the two lines, proceeding from the division of the linea aspera; by the condyles themselves, inferiorly, and also by the muscles which form the ham-strings. These are, the biceps, upon the outer side; and the semitendinosus and semimembranosus, assisted by the grassilus and sartorius, upon the inner side. Now it will be observed that the inner condyle descends much lower than the outer, and this is a very wise provision, for it compensates for the oblique position of the thigh bone. Both the thigh bones, it will be recollected, are separated at their heads by the whole width of the pelvis; but are drawn by their oblique position to a point below, so as to almost touch each other, at the knee. Now this could not be the case, without the internal condyle descended lower than the external. The symmetry of man's form would be incomplete, and progression would be rendered both graceless and awkward. The foramen for the transmission of the principal medullary artery is placed upon the back part of the bone, about two-thirds down. There are also numerous small holes upon the condyles, transmitting small vessels, nourishing the inferior part of the bone.

FORMATION OF THE HIP JOINT.

This joint is formed by the head of the os femoris and the acetabulum. It is the most complete ball and socket joint in the whole body, and it allows of motion being made in almost every direction. Thus we have flexion and extension, adduction and abduction, and also rotation.

BONES OF THE LEG.

The bones of the leg are three, *viz.*, the patella above, the tibia upon the inner side, and the fibula upon the outer side.

THE PATELLA,

Is placed in front of the knee joint, and when the leg is extended, it materially defends this joint from injury. It is cordiform or triangular in shape. The base of the triangle is placed above, and the apex below. The base is flattened superiorly, and to it and the sides of the bone the four extensors of the leg are attached: *viz.*, the rectus, cruræus and the two vasti. To the apex, the strongest ligament in the whole body, the ligamentum patella is attached. This ligament possesses such amazing strength, that the bone is almost always fractured rather than the ligament will become ruptured or give way. Anteriorly the bone is convex and porous, whilst posteriorly, it has two somewhat concave articulating surfaces, separated by a ridge. This ridge is received into a notch between the condyles of the femur anteriorly. Of the two surfaces, the outer is said to be the largest: they correspond to those found upon the femur.

THE TIBIA,

Passes down upon the inner side of the leg extending from the knee to the ankle. The upper part is called the head, from its being much expanded; it is spongy and rough, being marked by the attachment of the capsular ligament of the knee joint. superiorly we find two articulating surfaces upon which the condyles of the femur rest. The innermost of these surfaces is of an oval shape, the outermost is rounded or circular; between them a bifid tubercle projects, which is received into a notch between the two condyles of the femur. In front of this tubercle there is a depression, and a similar one behind; into these depressions the anterior and posterior crucial ligaments are inserted. Upon the fore part of the bone, about an inch below the head, is seen the proper tubercle, which receives the insertion of the ligamentum patella. Upon the outer and back part of the bone below the head, there is an articulating surface receiving the head of the fibula. Upon the upper and back part there is an oblique ridge receiving the insertion of the popliteus muscle. The shaft of the bone is of a prismatic, or triangular form, and has three distinct sharp edges. The anterior of these is the sharpest, and is called the shin, and this takes a winding course downwards; and it may be traced as far as the inner malleolus. The second, which may be called the external, is turned towards the fibula, and to it one side of the inter-osseous ligament is attached. It may be traced as far as the outer malleolus. The third, or the posterior, is placed upon the inner and back part, and gives origin to some of the flexors of the foot. It may be traced as far as the back part of the inner malleolus. As the bone descends, it becomes gradually narrower till it reaches within four or five inches of its lower end, when it again expands to be articulated to the tarsus. The narrow part is the most frequent seat of fracture. The inside of the shaft of the bone is smooth and flat, and is here merely covered by the common integuments and periosteum. The outer part is hollowed, lodging the tibialis anticus muscle. Descending downwards from the inner side of the lower extremity is seen the inner malleolus, which is articulated to the inner side of the astragalus, or first bone of the tarsus. On the opposite side there is a cavity called the semilunar cavity, receiving the fibula, as it descends to form the outer malleolus. Upon the lower extremity there is an articulating surface for connexion with the head of the astragalus. Behind the internal malleolus there is a groove, transmitting the tendons of the tibialis posticus and flexor longus digitorum pedis muscles. The foramen for the transmission of the principal nutritious artery is placed upon the back part of the bone, about one third down. The course which this opening takes is downwards, whilst in most of the bones of the upper extremity, it may be observed that it passes upwards. The tibia has been compared in shape to a musical pipe, the head resembling the trumpet, and the lower extremity the flute end of it; the mouth-piece being formed by the inner malleolus.

THE FIBULA,

So named from its resemblance to a Roman clasp, is a long slender bone passing down upon the outer side of the tibia. Its use is to strengthen the leg, to serve as a point for the origin of many muscles, but more particularly to form the ankle joint. It is of the same length as the tibia, which it lies beside like a splint, and in disease of the tibia the fibula not only preserves the form of the leg, but also forms its chief support; though it is not at all connected with the knee joint. The upper part is expanded and forms the head. On the inner side of this, there is a small flat articulating surface connecting it to the outer side of the head of the tibia, to which it is firmly tied by many strong ligaments; upon the top of the head there is a rough projecting tubercle, receiving the insertion of the biceps flexor cruris muscle, and external lateral ligament of the knee joint. The shaft of the bone, like the tibia, is triangular. Upon it we find an anterior and a posterior ridge; and between these ridges, surfaces, which are marked by the origin of muscles. The inner of the two ridges is for the attachment of the inter-osseous ligament. The lower part of the bone is considerably expanded, and forms the outer malleolus, and this is lodged in the semilunar cavity upon the outer side of the lower end of the tibia. Upon the inner side of this process is seen an articulating surface by which it is connected to the outer side of the astragalus. The lowermost point of this process is called by some anatomists the coronoid, which gives origin to ligaments going to the bones on the outer side of the foot. Behind this process there is a groove transmitting the tendons of the peroneus, longus, and brevis. The canal for the principal nutritious artery, is placed upon the back part of the bone, a little above the middle. This canal, like that of the tibia, slants obliquely downwards.

FORMATION OF THE KNEE JOINT.

This joint is formed by the condyles of the os femoris, the head of the tibia, and the patella. This little bone plays in a pulley formed between the condyles anteriorly. The projection of this bone upon the knee, removes the acting force from the centre of motion, so as to increase the power, and it is so beautifully contrived that while the knee is bent, and the muscles at rest, as in sitting, the patella sinks down concealed into a hollow of the knee. When the muscles begin to act, the patella rises from this hollow; in proportion as they contract they loose their strength, but the patella gradually rising increases their power; and when the contraction is nearly perfect, the patella has risen to the summit of the knee, so that the rising of the patella increases the mechanical power of the joint, in exact proportion as the contraction expands the living contractile power of the muscles. Hence it is that the patella is more readily fractured by the action of those strong muscles attached to it, the force of which is at least equal to the weight of a man's body.

The condyles rest upon the surfaces seen upon the head of the tibia, which in the recent subject are deepened by the semilunar cartilages. The motions of the knee joint are almost entirely confined to flexion and extension, but if we semiflex the leg, we relax the ligaments, and the tibia may then be very slightly rotated upon the condyles. In extension of the leg, the ligaments are put upon the stretch, and not the slightest degree of lateral motion can then be effected. In this joint very little security against accidents is afforded by the form of the bones. It is only by the ligaments, which are very numerous, that it is rendered strong. It is very much exposed, and is peculiarly liable to disease.

BONES OF THE FOOT.

The bones of the foot, like those of the hand, are arranged or divided into three orders, *viz.* those of the tarsus, metatarsus, and toes.

THE TARSUS

Is composed of seven bones, which are firmly compacted together; they are as follows:

The astragalus,
os calcis,
— naviculare,
— cuboides,
os cuneiforme externum,
cuneiforme medium,
cuneiforme internum.

The tarsus is convex above and concave below, and in the concavity, numerous muscles, vessels, and nerves forming the sole of the foot are lodged, and by the arch-like form of the foot are defended from pressure.

The astragalus is placed at the upper part of the foot, and is of an irregular form. The upper part is called its head; this is broader anteriorly than posteriorly, and is covered with an articulating surface for connexion with the lower end of the tibia. On each side of the head there are two articulating surfaces, of which the external is the longest; the internal is for connexion with the internal malleolus; the external, which descends much lower than the internal, is connected with the external malleolus. Upon the lower part of the bone, are seen two other surfaces, which are separated by a sulcus. The outer of these, which is much posterior to the other, is connected to the upper and middle part of the os calcis. The inner, or anterior, is also connected to a projection upon the inner and fore part of the os calcis. The astragalus is oblong upon the fore part, and has a convex process called its second head; this is covered with an articulating surface for connexion with the back part of the os naviculare. The general connexions of this bone then are as follows: its head is connected to the lower end of the tibia, upon its outer side it is connected to the external malleolus, upon its inner side, to the internal malleolus. It is connected below to the os calcis, and to the os naviculare in front.

The os calcis, or heel bone is the largest of all the tarsal bones situated below the astragalus in the back part of the foot. It has a projecting process behind called the head. Upon the upper part of this process, there is a rough surface receiving the insertion of the tendo achillis. Upon the head inferiorly, there are two tubercles or points, upon which the body rests in the erect position. The external surface of this bone is nearly flat, whilst the internal is much excavated, in order that the blood-vessels and nerves may pass into the sole of the foot free from pressure. On the upper and fore part, there are two articulating surfaces, by which it is connected to the inferior and posterior part of the astragalus. Inferiorly, and in advance of these surfaces, there is another surface by which it is connected to the back part of the os cuboides; so that it is sufficient to say that it is connected above to the astragalus, and in front to the os cuboides.

The os naviculare is placed in front of the astragalus, and upon the inner side of the tarsus; it is convex above, and is of an irregular form below; posteriorly there is a large cavity (said to resemble that of a boat, hence its name) which is lined by an articulating surface connecting it to the second head of the astragalus. Anteriorly the bone is convex, and is covered by three articulating surfaces, receiving the back part of the three ossa cuneiformia. Sometimes there is a small surface on the outer side, by which it is connected to the os cuboides. The internal part of the bone is broader than the external, and has a projection receiving the insertions of tendons, muscles, and ligaments; its connexions are as follow: posteriorly it is connected to the second head of the astragalus; in front it supports the three ossa cuneiformia; and upon its outer side it just touches the os cuboides.

Os cuboides, so named from its cubical figure, is placed upon the outer side of the tarsus, and in front of the os calcis; it is more expanded superiorly than inferiorly. Upon its under surface there is a ridge, and in front of that a groove, through which the tendon of the peroneus longus passes in its course across the sole of the foot, towards its insertion at the great toe. Upon its under and posterior end there is a small flat surface receiving one of the ossa sessamoidea. On its inner side there is another small surface by which it is connected to the cuneiforme externum; it has two more surfaces in front connecting it to the metatarsal bones of the two last toes; its connexions are as follow: posteriorly it is connected to the lower and fore part of the os calcis; on its inner side it is connected to the cuneiforme externum; in front it supports the matatarsal bones of the two last toes, and also upon its inner and back part it just touches the os naviculare.

The cuneiforme bones are named from their being wedge-shaped, and certainly in the foot they strictly merit that appellation; they are arranged precisely in the same manner as the stones of an arch. Of the three bones, the *os cuneiforme* internum is much the largest, and the medium is the least; they are placed in front of the navicular bone, upon the inner side of the tarsus. The broadest part of the cuneiforme internum is placed below, whilst that of the medium and externum is placed above. Upon the back part of the cuneiforme internum there is an articulating surface connecting it to the fore part of the os naviculare, and in front there is another surface by which it is connected to the metatarsal bone of the great toe, and in part to the second toe. On its outer side it joins the cuneiforme medium.

The medium is completely wedge-shaped, and more so than either of the others; upon the back part it is connected by a smooth surface to the os naviculare, externally it joins the cuneiforme externum, and internally the cuneiforme internum. In front it partly supports the metatarsal bone of the second toe.

The cuneiforme externum is also wedge-shaped; it is connected behind by a flat surface to the os naviculare. Internally it joins the medium, and externally the os cuboides; anteriorly it supports the metatarsal of the third toe, and also joins that of the second toe.

FORMATION OF THE ANKLE JOINT.

The ankle joint is formed by the lower extremities of the tibia and fibula, and also by the head of the astragalus. It is one of the most complete hinge joints in the whole body; no lateral or rotatory motion being allowed, except when the foot is placed flat upon the ground and extended forwards, in which case the tibia is thrown upon the posterior part of the head of the astragalus, which is much narrower than the anterior, and then a little of each is permitted, but even then in a very slight degree. The external malleolus always descends lower than the internal, whereby the joint is considerably strengthened, and in addition, there are strong ligaments tying the bones together, and numerous tendons which pass over the joint and very materially defend it from injury. The bones of the tarsus are firmly connected together by strong ligaments and cartilages. Each bone has its cartilage, its synovial capsule, and all the apparatus of a regular joint. There are two distinct joints in the tarsus, nearly in a line with each other. The first of these joints is placed upon the inner side of the foot, between the os calcis and os naviculare. That upon the outer part of the foot is placed between the os calcis and os cuboides. The motions of the tarsus are very much confined, a slight yielding of the bones being all that is allowed.

THE METATARSUS,

Like the metacarpus, is formed of five bones. These are divided into bases, bodies and heads. Their bases, which are placed superiorly, are connected to the fore part of the tarsal bones. Their heads are placed inferiorly, and possess convex and round articulating surfaces forming balls, which are received into sockets placed upon the bases of the first row of phalanges. Their bodies are those portions intervening between the two. These bones are flat above, and somewhat concave below, and their bases project very much backward inferiorly; the spaces between them are filled up with the inter ossei muscles and ligaments. The metatarsal bone of the great toe is the shortest and thickest, but it is much the strongest, and the articulating surface upon its base is much deeper than any of the others, and is of a triangular shape. The metatarsal bone of the second toe is the longest of the five. That of the third is the next in size; the triangular surface upon its base is a little larger than that of the second toe, to be articulated with the os cuneiforme externum. The metatarsal bone of the fourth toe is nearly of the same length as the former, but may be distinguished by the articulating surface upon its base being more of a square form by corresponding with the anterior and inner part of the os cuboides, with which it is articulated. The metatarsal bone of the little toe is the shortest; its base, which is connected to the os cuboides, has a projecting process which receives the insertion of the peroneus brevis, and it forms one of the chief points upon which the body rests, in the erect position.

THE TOES.

Each consist of three rows of phalanges excepting the great toe, which has but two. The phalanges are much shorter than those of the fingers; they are excavated inferiorly, lodging the flexor tendons.

The two bones of the great toe, like those of the thumb, are shorter and stronger, but they are placed in the same row as those of the other toes. The same motions in the toes are permitted as in the hand, and much more so than our dress will allow of. The joints are precisely the same. Thus between the heads of the metatarsal bones and bases of the first row of phalanges, there are ball and socket joints, strengthened by strong ligaments and admitting only of flexion and extension; between the phalanges themselves there are hinge joints allowing of the same motion. Very frequently however, the two last joints of the little toe become anchylosed.

Ossa Sessamoidea,

Are so named from their resemblance to the sesamum, or oily grain. Their size, number, and situation, vary in different persons. Two are generally placed at the ball of the great toe, and one at the ball of the little toe; and sometimes one is found in the tendon of the peroneus longus. They are inclosed by ligaments and tendons, and they are lined with cartilage, by which means they play upon the bones with which they are articulated.

THE ARCHES OF THE FOOT.

On examining the foot, we find that the bones of it are so wisely and beautifully arranged as to form two distinct arches. The first of these, which is the larger, extends in a longitudinal direction from the os calcis to the heads of the metatarsal bones. The second or smaller, extends in the transverse direction between the metatarsal bones themselves. These arches not only very considerably increase the strength and elasticity of the foot, but they also add to its figure and beauty. When the foot is placed flat upon the ground, they are more distinctly seen, and although it is constructed of so many irregular shaped bones, yet the utmost order and regularity in their arrangement is observed. They are firmly connected to each other by ligaments and cartilage, and require very extraordinary force to displace them.

BONES OF THE HEAD.

Whilst the bones in general serve as a bases for the soft parts, and for supporting and directing the motions of the body, certain bones have a higher use, in containing those organs whose functions are most essential to life. Thus the skull defends the brain; the spine, the prolongation of the brain, and the ribs and sternum, that of the heart and lungs. The minute anatomy of the skull should be thoroughly understood by every student. It is as essential to an accurate knowledge of the brain, as the bones of the extremities are to that of the muscles. It explains to us in some degree the organs of sense, and it instructs us in the knowledge of all those accidents of the head, which are so often fatal; and so frequently require the boldest of our operations. It is the most difficult and complicated study in the human body, and can only be acquired by patient industry and undeviating assiduity. The mode of instruction however, which is now observed in anatomical schools, but more particularly at the Webb-street school, is calculated to render this study comparatively easy. There, its teachers, not satisfied with merely giving a single lecture, or a single demonstration of these bones in a course of lectures, give repeated demonstrations of them, and of the most difficult parts ; and thus the student acquires a knowledge of the most prominent features of each individual bone before he commences to study them in his closet. Such a mode of proceeding tends materially to advance the pupil in the most interesting part of his professional studies; and it not only reflects the highest credit upon its teachers, but is calculated to immortalize their school to the latest posterity.

If we examine the head, the most important part of the body, we shall find that it is composed of many bones, which in their arrangement, display superior wisdom and ingenuity. These bones form a complete arch, and in the adult are so firmly joined together as to resist a most extraordinary degree of force. They consist of two tables, an external and an internal, which are separated from each other by what is called the diploe. The external is the thicker, is more spongy, but is less easily broken. The internal is thinner, but more compact, and more readily fractured. The diploe, or cancelli as it is also called, consists of a net work of vessels, secreting the marrow, and nourishing the bone. The vessels of the diploe have a free connexion with the vessels of the dura mater, and also with those of the pericranium, as is evidenced by the death of the bone, when a portion of either of these membranes is injured or destroyed. In trephining the head of an adult, an alteration in the sound which the instrument makes, accompanied with a slight issuing of blood, warns us of our having perforated the external table, and reached the diploe; but in an old subject this guide no longer exists, the diploe giving place to the deposition of ossific matter, and the two plates become condensed into one. It therefore behoves us to be extremely careful, and it is our duty to examine from time to time with a probe, lest we should wound the dura mater or injure the brain.

DESCRIPTION OF THE BONES OF THE HEAD,

The bones of the head are divided into those of the cranium and those of the face. They are eight in number, and consist of six proper and two common. They are as follow: the os frontis, placed anteriorly; os occipitis behind; two ossa parietalia upon the upper part and sides, and the ossa temporum placed upon the sides of the ossa parietalia inferiorly. These six are proper to the cranium; that is to say, they belong to the head alone. There are two others which are common both to the head and the face, and they are the os æthmoides, and os sphenoides; these two last are quite hidden in the base of the skull. All these bones are connected together by numerous seams or sutures, which are as follow:

It has been called squamous from the upper edges of the temporal bones overlapping the inferior edges of the parietal bones, like the scales of armour. The continuation of this suture posteriorly has received the name of additamentum sutura squamosa. It connects the ossa parietalia to the temporal bones, and also the temporal to the sphenoid. The sphenoidal and æthmoidal sutures surround those two bones, and join them to each other and to the rest.

The transverse suture connects in part the bones of the head to those of the face. It commences at the external angular process of the os frontis; it crosses one orbit between the bones of the head and those of the face; it then runs over the root of the nose and crosses in a similar manner the opposite orbit, and finally terminates at the opposite external angular process of the os frontis.

The zygomatic suture merely connects the zygomatic process of the os malæ to the same process of the os temporis, forming an arch called the zygoma or yoke, under commences at the root of the mastoid process of the temporal bone, it passes upwards and backwards to the termination of the sagittal. It then descends downwards and forwards to the same point upon the opposite side. It connects the os occipitis to the back part of the ossa parietalia. The continuation of this suture to the base of the skull has been called additamentum sutura lambdoidalis. It commences at the root of the mastoid process; that is, at the point from which the lambdoidal suture itself begins; it then descends upon the inner side of that process, and passes forwards, and inwards, till it reaches the base of the skull, and it there terminates at the foramen lacerum basis cranii posterius. It connects the os occipitis to the back part of the os temporis, on either side. The squamous suture commences at the root of the mastoid process; it passes in an arched direction above the temporal bone, it then descends underneath the zygoma, passes backwards on the inner side of the glenoid cavity of the os temporis, and terminates in its continuation at the base of the skull.

It has been called squamous from the upper edges of the temporal bones overlapping the inferior edges of the parietal bones, like the scales of armour. The continuation of this suture posteriorly has received the name of additamentum sutura squamosa. It connects the ossa parietalia to the temporal bones, and also the temporal to the sphenoid. The sphenoidal and æthmoidal sutures surround those two bones, and join them to each other and to the rest.

The transverse suture connects in part the bones of the head to those of the face. It commences at the external angular process of the os frontis; it crosses one orbit between the bones of the head and those of the face; it then runs over the root of the nose and crosses in a similar manner the opposite orbit, and finally terminates at the opposite external angular process of the os frontis.

The zygomatic suture merely connects the zygomatic process of the os male to the same process of the os temporis, forming an arch called the zygoma or yoke, under which the temporal muscle passes to be inserted.

In the lambdoidal suture we frequently find some ossa triquetra or Wormiana from their describer. Their existence should be borne in mind, as they may be mistaken for fractures. The frontal suture is rarely seen in an adult; though always in the fœtus, and frequently in the female. It divides the os frontis into two portions. It commences at the nasal process of the os frontis, it passes in a straight direction upwards and backwards to the sagittal, of which the latter may be said to be its continuation.

Os Frontis,

This bone resembles in shape a cockle-shell. It is placed in the upper and fore part of the skull, and is so named from its situation. Externally it is smooth and convex; upon each side of the centre there are two prominences which point out the situation in which ossification first commenced in the fœtus. Inferiorly the bone is contracted, and forms the superciliary ridges; each of these ridges are bounded

1. *The coronal,*
2. *The sagittal,*
3. *The lambdoidal,*
4. *The temporal or squamous,*
5. *The sphenoidal,*
6. *The ethmoidal,*
7. *The transverse,*
8. *The Zygomatic.*

The coronal, so named from the ancients wearing their garlands just over that part, commences about an inch behind the external angular process of the os frontis. It ascends upwards and backwards, till it reaches the top of the head. It then descends downwards and forwards to the same point on the opposite side from which we began to trace it. It connects the back part of the os frontis to the fore part of the ossa parietalia.

The sagittal suture commences from the centre of the coronal, it passes in a straight direction backwards to the centre of the lambdoidal. It has been named sagittal from its lying between these two sutures like an arrow between the string and the bow. It connects the ossa parietalia to each other.

The lambdoidal (so named from its resemblance to the Greek letter Λ lambda)

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It has been called squamous from the upper edges of the temporal bones overlapping the inferior edges of the parietal bones, like the scales of armour. The continuation of this suture posteriorly has received the name of additamentum sutura squamosa. It connects the ossa parietalia to the temporal bones, and also the temporal to the sphenoid. The sphenoidal and æthmoidal sutures surround those two bones, and join them to each other and to the rest.

The transverse suture connects in part the bones of the head to those of the face. It commences at the external angular process of the os frontis; it crosses one orbit between the bones of the head and those of the face; it then runs over the root of the nose and crosses in a similar manner the opposite orbit, and finally terminates at the opposite external angular process of the os frontis.

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In the lambdoidal suture we frequently find some ossa triquetra or Wormiana from their describer. Their existence should be borne in mind, as they may be mistaken for fractures. The frontal suture is rarely seen in an adult; though always in the fœtus, and frequently in the female. It divides the os frontis into two portions. It commences at the nasal process of the os frontis, it passes in a straight direction upwards and backwards to the sagittal, of which the latter may be said to be its continuation.

Os Frontis,

This bone resembles in shape a cockle-shell. It is placed in the upper and fore part of the skull, and is so named from its situation. Externally it is smooth and convex; upon each side of the centre there are two prominences which point out the situation in which ossification first commenced in the fœtus. Inferiorly the bone is contracted, and forms the superciliary ridges; each of these ridges are bounded by an external and internal angular process. Inclined a little to the inner side of the centre of these ridges, is seen the foramen supra orbitarium. Occasionally, however, there is merely a notch; it transmits the supra orbitar blood-vessels and nerve. More internally than this foramen there is a groove which transmits the tendon of the trochlearis, or superior oblique of the eye in its course to its insertion. Above the internal angular processes there are two eminences, which point out the situation of the frontal sinuses; between the two internal angular processes, the nasal process projects a little downwards, and has a serrated edge on each side for supporting more firmly the two small nasal bones. Proceeding backwards from the external angular processes, we perceive a portion of the temporal ridge, and below this the bone is somewhat excavated forming a part of the temporal fossa. Proceeding also backwards from the superciliary ridges in an arched direction are seen the orbitar processes. At the outer part of each orbitar process, there is a depression or fossa, lodging the lachrymal gland. Between the orbitar processes there is a space called the fissura æthmoidalis, in which the æthmoid bone is received. Underneath the nasal process there are two openings leading into the frontal sinuses. On examining the internal part of the bone, we find that it is concave, and is slightly marked by the convolutions of the brain. There are also several grooves or sulci lodging the arteries of the dura mater. In the centre of the bone, anteriorly, the spine is seen, which commences at a small opening called the foramen cœcum; it is very prominent at its commencement, but as it ascends it decreases, and finally appears to split into two, and between the two portions there is a groove formed. To the spine the falx major is attached, and the groove which is the continuation of it, lodges the commencement of the superior longitudinal sinus. The fissura æthmoidalis is also seen internally, and upon each side of it, the orbitar plates of the frontal bone. They are thin and semi-transparent, and are very much marked by the convolutions of the brain. They support the anterior lobes of the cerebrum. This bone is connected to the ossa parietalia behind, anteriorly on either side by its external angular processes, to the ossa malarum. Anteriorly also and inferiorly to the ossa nasi and nasal processes of the superior maxillary bones. Posteriorly and inferiorly (in the orbit) to the æthmoid and palate bones, and behind and laterally to the sphenoid.

Ossa Parietalia,

So named from their forming the walls of the skull. They form by far the greatest part of the cranium. They are much more exposed then the others, are the most frequently fractured, and the most easily trephined: each bone is quadrangular in form. Rather to the lower side of the centre there is a prominence which indicates the point where ossification first commenced in the fœtus. It is convex and smooth externally, whilst internally it is concave. This concavity is marked by the convolutions of the brain. The superior, anterior, and posterior edges are all serrated, whilst the inferior terminates in a thin squamous edge, which is overlapped by the squamous portion of the temporal bone. Upon the upper part of the bone posteriorly, we find the foramen parietale, transmitting a vein to the superior longitudinal sinus. Upon the internal part of the bone there are numerous sulci or grooves, lodging the arteries of the dura mater, but there are two large ones in particular, which require to be taken notice of as *landmarks*, in reference to trephining in these parts. One of these grooves, which is the larger, is placed opposite to the anterior and inferior angle of the bone, and lodges the arteria menningea media, the great artery of the dura mater. The other, the smaller, is placed opposite to the posterior and inferior angle of the bone, and it lodges the posterior meningeal artery. Upon the very point of the posterior and inferior angle, there is also a small portion of another very large and deep groove, which transmits a portion of the lateral sinus. When the upper edges of each bone are approximated, there is another large groove formed between them, which takes its course beneath the sagittal suture to the end of the bone, and then becomes continuous with a similar groove upon the occipital bone; it transmits the continuation of the superior longitudinal sinus. This bone is connected to the temporal and sphenoid inferiorly, to the occipital behind, above to its fellow, and anteriorly to the frontal. The meeting of the frontal and parietal bones being imperfect in the child, there is a membraneous interstice left, which, from its resemblance to the trefoil leaf, has been called foliolum, and by the ancients hypothetically bregma fons pulsatilis, or beating fountain, the pulsation of the arteries of the brain being felt there, and they considered it as a drain of moisture from the brain.

Os Occipitis,

So named from its being placed in the posterior part of the skull forming the occiput. The superior part of this bone has been said to be somewhat triangular in shape, and is also smooth and convex. Below this triangular portion are seen the external crucial ridges, which are here formed by one perpendicular and two transverse spines. To the superior transverse ridge, the trapezius, splenius capitis, and complexus muscles are attached. To the inferior transverse ridge, the small rotators of the head are attached. Upon the top of the perpendicular spine, we find the tuberosity of the occipital bone, and to this the ligamentum nuchæ is attached. At the termination of the perpendicular spine is seen the foramen magnum, transmitting the medulla spinalis and vertebral vein. Upon the sides of this foramen, anteriorly, we find two condyloid processes, each of which is convex, and is covered with an oblong articulating surface for articulation with the concave superior articulating processes of the atlas. Behind the condyloid processes are seen two foramina called the foramina condyloidea posteriora, to distinguish them from two others placed anteriorly, the foramina condyloidea anteriora. Upon the outer side of the two last openings, and at the same time somewhat behind them, there are two grooves which terminate anteriorly in two excavations, assisting in the formation of the foramen lacerum basis, cranii posterius, and transmitting the termination of the lateral sinus on either side, which here forms the commencement of the internal jugular vein. In front of the foramen magnum, the basilar or cuneiforme process is placed. This passes upwards and forwards, and terminates anteriorly, rough and spongy for connexion with the body of the sphenoid bone. The internal part of the bone is divided into four fossa by means of the crucial ridges, which are here formed of one perpendicular and one transverse spine. The two superior fossa lodge the posterior lobes of the cerebrum; the inferior the two lobes of the cerebellum. To the upper half of the perpendicular spine the termination of the falx major is attached, to the lower half of it the falx minor, to the transverse ridge the tentorium cerebelli is attached. Upon the upper half of the perpendicular spine there is a groove which lodges the termination of the superior longitudinal sinus. Running along each transverse ridge, there is another large groove, which transmits the lateral sinuses. At the termination of the perpendicular spine is seen the foramen magnum; upon the sides of this foramen there are two small grooves which transmit the lateral sinuses after having run upon the petrous portions of the temporal bones. Upon the sides of these grooves there are two excavations which assist in the formation of the foramen lacerum basis, cranii posterius. Upon each side of the foramen magnum anteriorly, we see the foramina condyloidea anteriora, which transmit the ninth pair of nerves. The foramina condyloidea posteriora are seldom seen internally; in front of the foramen magnum, the basilar or cuneiforme processes is seen passing upwards and forwards; it is considerably hollowed, lodging the pons Varolii, and medulla oblongata, and some important blood-vessels. The os occipitis is connected on the fore part to the ossa parietalia: inferiorly to the temporal and sphenoid bones, and also to the atlas or first vertebra of the neck.

Os Temporis

Is divided into two portions, *viz.* squamous and petrous. It is situated in the inferior and lateral portion of the cranium. The upper and outer part of this bone is smooth and convex, and has received the name of pars squamosa, and the superior edge of this portion overlaps the inferior and lateral portion of the parietal bone. Projecting from the inner part of the squamous portion, we see the zygomatic process. This process passes outwards and forwards to join a similar process of the os male, and thus the zygoma or jugum is formed, underneath which the temporal muscle passes to be inserted. Between the root of the zygomatic process and the squamous plate, the bone is hollowed, lodging the temporal muscle. Behind the zygomatic process we find the glenoid cavity which receives the condyle of the lower jaw; being lined with an articulating surface for that purpose. This articulating surface extends some way upon the root of the zygoma, which is here rather prominent, and takes the name of eminentia articularis: it also extends upon the vaginal process, a small plate of bone which passes nearly perpendicularly downwards upon the inner side of the glenoid cavity, and surrounds the root of the styloid process. Running across this cavity is seen the fissura glaceri, which transmits the chorda tympani. Behind the glenoid cavity is seen a large opening, the meatus auditorius externus, or entrance of the external ear; and immediately behind and rather below this, the mastoid process projects downwards, giving insertion to strong muscles, but more particularly to the sterno cleido mastoideus. On the inner side of the root of this process there is a depression or groove which gives origin to the posterior belly of the digastricus muscle. At the root of the same process posteriorly, and about half an inch higher than the depression which gives origin to the digastricus muscle, there is a hole called the foramen mastoideum. It transmits a small vein, either to the lateral sinus, integuments of the head, or an artery to the dura mater.

Upon the inner side of the vaginal process, we see the styloid process, so named from its resemblance to the stylus, or point with which the ancients engraved their writings on tablets of wax. It remains cartilaginous for many years after birth, and gives origin to three distinct muscles, *viz.* the stylo-hyoideus, stylo-pharyngæus, and stylo-glossus. Between the styloid and mastoid processes, the foramen stylo-mastoideum is placed, which transmits the portio dura of the seventh pair of nerves.

The internal part of the squamous portion is concave, and is marked by the convolutions of the brain; several sulci are also seen, lodging the branches of the arteries of the dura mater. Opposite to the mastoid process internally, there is a large and deep groove, which transmits a considerable portion of the lateral sinus just before it runs a second time upon the occipital, to make its exit from the skull. The largest part of the temporal bone projects internally, and has received the name of pars petrosa, or petrous portion, from its peculiar hardness. It runs obliquely forwards and inwards, and contains the internal ear. Upon the fore part of it we find a small opening called the foramen innominatum, transmitting the nervus innominatus. Upon the back part there is a larger opening, the meatus auditorius internus, or foramen auditivum internum, transmitting the seventh pair of nerves, and internal auditory artery. Behind and to the inner side of this, there is an excavation which assists in forming the foramen lacerum basis, cranii posterius. Upon the back part of the petrous portion we sometimes find one or two small openings leading from the aqueducts of Cotunnius. Upon the under part of the petrous portion there is an opening which, in the natural situation of the bone, is directly beneath the foramen auditivum internum. It is called the foramen caroticum, and leads into the canalis caroticus, or carotid canal. This canal passes upwards, forwards, and inwards, and terminates by an irregular opening upon the under and fore part of the petrous portion; it transmits the internal carotid artery, and a branch of the sixth pair of nerves, which, uniting with the vidian nerve, forms the commencement of the great sympathetic. Behind, and to the outer side of the foramen caroticum there is a small but deep excavation called the fossa-jugularis. It lodges the commencement of the internal jugular vein. In front of the foramen caroticum, but between it and the spinous process of the sphenoid bone, we find an irregular opening from the Eustachian tube, or the iter a palato ad aurem. Both the anterior and posterior surfaces of the petrous portion are irregular where they are opposed to the middle lobes of the brain and cerebellum. Upon the upper part of the petrous portion there is a sharpe ridge, to which the tentorium is attached; upon this ridge there is a groove (in some subjects more or less distinct) lodging the superior petrosal sinus. The temporal bone is connected superiorly to the parietal by the squamous suture. To the back part of the sphenoid by the additamentum of the squamous suture, and to the occipital by the additamentum of the lambdoidal suture. It is also connected in front by the zygomatic suture to the os male; and inferiorly it is articulated by means of the glenoid cavity to the condyle of the lower jaw.

Os Æthmoides,

Is one of the most curious bones in the whole body. It is of a cube-like form but is not solid, being exceedingly light, and consists of several convoluted plates, which form a network not unlike a honeycomb. It is curiously inclosed between the orbitar processes of the os frontis. The upper part consists of a sieve-like structure, called its cribriform plate. Projecting from the fore part of this plate, is seen the crista galli, to which the commencement of the falx major is attached. In front of this process there is a slight notch or excavation, which assists in forming the foramen cœcum. Projecting from the under part of the bone, is seen the nasal lamella which enters into the formation of the septum narium. Upon the sides of the nasal lamella the ossa spongiosa superiora are placed, and below these there are two others, the ossa spongiosa inferiora. These bones hang down from the sides of the septum narium, and are each rolled up like a scroll of parchment. Upon the sides, and more externally than the spongy bones, there are two plates of bone remarkably thin and smooth, which form a great part of the orbit, lying upon its inner side. This smooth portion on each side has received the name of os planum. Between the os spongiosum superius and os planum, on each side, there is a large cavity extending superiorly as high as the cribiform plate, which is called the æthmoidal sinus. Between the ossa plana and orbitar plates of the os frontis, there are two openings upon each side, called the foramina orbitaria interna, anterius et posterius. This bone is connected to the os frontis, where it is received into the æthmoidal fissure; to the sphenoid by a suture common to the two bones, and it is also connected to the vomer os unguis and os maxillare superius upon each side.

Os Sphenoides.

The sphenoidal bone completes the cranium, and closes it below. It is also named cuneiforme or wedge-like bone from its being wedged in between all the other bones of the cranium. In shape it somewhat resembles a bat with its wings extended, and hence it has received the name of pterygoid bone. The temporal processes forming the wings, and the pterygoid processes the feet, and its middle is like the body and head. The body of this bone is placed in the centre, and is much excavated in order to receive the pituitary gland. Upon the fore part of the body there are two processes called the anterior clinoid, to distinguish them from two others placed posteriorly, the posterior clinoid processes. These processes form the anterior and posterior boundaries of this excavated part, which has received the name of sella turcica. The two anterior clinoid processes arising from the fore part of the body of the bone are widely separated from each other, whilst the posterior, arising from a common base, afterwards diverge, and thus they differ from the anterior. Proceeding transversely outwards from the anterior clinoid processes are seen the transverse spines to which the tentorium cerebelli is attached. Upon the sides of the sella turcica the alæ or wings are situated, and these are hollowed for supporting in part the middle lobes of the cerebrum. Each alæ possesses three processes: the first called the orbitar, is placed anteriorly, and forms a part of the outside of the orbit. The second is called the temporal, and is placed externally. Each temporal process rises high up and forms a part of the hollow of the temple and by meeting the frontal parietal and temporal bones, by a thin scaly edge, it also forms a part of the squamous suture. The third, called the spinous, is placed behind, and sinks in under the petrous portion of the temporal bone. On the back part of the body of the bone there is a rough surface by which it is connected with the cuneiforme process of the os occipitis. In front of the anterior clinoid processes there are two large and round openings called the foramina optica. Between the transverse spines and alæ of the bone, the foramina lacera orbitalia superiora are placed, and behind these there are two other openings, called the foramina rotunda. Behind, and to the outer side of these, we see the foramina ovalia, and still more outwardly and posteriorly are the foramina spinosa. Upon the back part of the sella turcica there are two grooves (one upon each side) which transmit the internal carotid arteries. At the roots of the anterior clinoid processes there is a prominence called the processus Olivaris, it separates the optic nerves from each other. Upon examining the anterior part of the bone we see a projecting process called the processus azygos, which is connected to the nasal lamella of the æthmoid bone, and when it is joined to the vomer it completes the osseous part of the septum narium. Upon the sides of the azygos process there are two thin plates of bone which from their shape have been called ossa triangularia, and on removing them we expose the sphenoidal sinuses. These sinuses are two large cavities occupying nearly the whole of the body of the bone. They are separated from each other by a thin bony septum. Proceeding downwards from the inferior part of the bone, we see the two pterygoid processes, which are divided into an external and internal pterygoid plate, and hence they are often described as four processes. Of these two plates the internal is much the largest, whilst the external is shorter and broader, and extends farther back than the internal. The internal terminates inferiorly, in a hook-like or unciform process, and upon the point of it, there is a pulley in which the tendon of the tensor circumflexus palati muscle plays.

In addition to the foramina, seen internally, there are two others which are placed just at the roots of the pterygoid processes, called the foramina pterygoidea; they lead into the pterygoid canals which pass above the pterygoid processes, and transmit branches of arteries and nerves. The sphenoid bone is connected to all the bones of the cranium and to several of the face.

Having described the bones of the cranium separately, we shall now give a general repetition of the parts seen at the external and internal basis of the skull.

Anteriorly and in the centre, we find the crista galli of the æthmoid bone. Upon each side of this is seen the cribriform plate of the same bone, and still more outwardly and laterally, are the orbitar processes of the os frontis. These processes support the anterior lobes of the brain, and are marked by its convolutions. In front of the crista galli we see the foramen cœcum, and in advance of this, the spinous process of the os frontis. In the centre of the internal basis, but more posteriorly, we find the sella turcica, which is bounded anteriorly and posteriorly by the anterior and posterior clinoid processes. Behind the sella turcica, but still in the centre, the cuneiforme process of the os occipitis is situated. At the termination of this process we find the foramen magnum, and beyond this are seen the crucial ridges, which are formed internally of a transverse and perpendicular spine. Upon the sides of the sella turcica there are two large cavities which are bounded anteriorly by the transverse spines, and alæ of the sphenoid bone, and posteriorly by the petrous portion of the temporal bones. These cavities receive the middle lobes of the cerebrum. Between the petrous portions of the temporal bones and the transverse ridge of the occipital, there are two others which receive the two lobes of the cerebellum. The space above the transverse ridge of the occipital bone, extending as far forwards as the petrous portions of the temporal bones, is wholly occupied by the posterior lobes of the cerebrum.

Of the principal Foramina seen internally.

The first of these, called the foramina optica, are placed just in front of the anterior clinoid processes of the sphenoid bone, and transmit the optic or second pair of nerves and opthalimic arteries to the eye. Between the transverse spines and alæ of the sphenoid bone, we see the foramina lacera orbitalia superiora which transmit the third pair of nerves, the fourth pair, the first division of the fifth pair, called the opthalmic, and the sixth pair, and also the opthalmic veins. Behind these openings the foramina rotunda are placed, transmitting the second division of the fifth pair of nerves, called the superior maxillary. Behind, and to the outer side of the foramina rotunda, we find the foramina ovalia, which transmit the third division of the fifth pair, called the inferior maxillary; and still more outwardly and posteriorly the foramina spinosa are placed, transmitting the arteria meningea media, or the great artery of the dura mater. Next in order, we find two irregular openings placed between the petrous portions of the temporal bones, and body of the sphenoid, transmitting the internal carotid arteries. Upon the back part of the petrous portion of each temporal bone, the foramen auditivum internum is placed, transmitting the seventh pair of nerves, called auditory; and also the blood-vessels of the internal ear. Between the back part of the petrous portions of the temporal bones, and sides of the occipital we find the foramina lucera basis cranii posterius, which transmit the par vagum, or eighth pair; also the accessory nerves and internal jugular veins. Upon the fore part and sides of the foramen magnum, we see the foramina condyloidea anteriora, transmitting the ninth pair of nerves. And lastly we have the foramen magnum itself, for the passage of the medulla spinalis, with its vessels and membranes; also the vertebral arteries and accessory nerves. In addition to this description of the principal foramina, there are several smaller ones. The first of which is the foramen cœcum; it is placed just in front of the crista galli, between it and the spinous process of the os frontis; it transmits a small vein which forms the commencement of the superior longitudinal sinus. Next we find the foramina of the cribriform plate, which transmit small filaments of the first pair of nerves called olfactory. Between the temporal and sphenoid bones, and on the inner side of the fissures for the internal carotid arteries, there are two irregular openings called the foramina lacera basis cranii anterius. In the recent subject they are nearly filled up with ligaments, and merely transmit small branches of nerves and arteries. Upon the fore part of the petrous portions of the temporal bones we find two small openings, called the foramina innominata, transmitting the nervus innominatus upon each side. Lastly, upon the back part of the petrous portions there are two very small openings from the aqueducts of Cotunnis.

Description of the parts seen at the external basis.

In the centre, anteriorly, we find the nasal lamella of the æthmoid bone, and upon the sides of this are the cribriform plates of the same bone. Upon the sides of the nasal lamella, but rather more outwardly, the superior and inferior spongy bones are placed, and upon the outer side of these we find the æthmoidal sinuses. Still more externally we find the ossa plana, and upon each side of these we have the orbitar processes of the os frontis. In the centre of the external basis, but more posteriorly than the nasal lamella, the azygos process of the sphenoid bone is placed, and upon the sides of that process we find the two pterygoid processes, and still farther outwards, portions of the alæ of the bone. To the outer side of the alæ, the zygomatic processes of the temporal bones are situated. In a line posteriorly with the processus azygos, we see the basilar process of the os occipitis, and at the termination of this process we find the foramen magnum. Upon the sides of this foramen the condyloid processes are placed. Upon the sides of the basilar process we see the petrous portions of the temporal bones; still more laterally, the glenoid cavities of the same bones, and more laterally and externally than these, we find the styloid, vaginal, and mastoid processes upon each side. Finally, behind the foramen magnum, we see the external crucial ridges, which are here formed of one perpendicular and two transverse spines.

Of the Foramina seen externally, which are not seen internally.

The first are the foramina pterygoidea, placed at the root of the pterygoid processes. Next we find an irregular shaped opening upon each side, placed just in front of the foramen caroticum, between it and the spinous process of the sphenoid bone from the Eustachian tube; just upon the inner side, and a little in advance of the vaginal process, the foramina carotica are situated. They lead into the carotid canal, and terminate by an irregular opening upon the under and fore part of the petrous portion, and consequently they do not pass directly through the base of the skull. Upon the outer and back part of the glenoid cavity, on each side, we find the meatus auditivus externus, and at the root of the mastoid processes, posteriorly, we find the foramina mastoidea, transmitting veins to the lateral sinuses. On the inner side of the vaginal processes, between them and the styloid, we find the foramina stylo mastoidea, transmitting the portio dura of the seventh pair of nerves.

Behind the condyloid processes of the os occipitis, we see the foramina condyloidea posteriora, transmitting small veins to the lateral sinuses, or an artery to the dura mater. Lastly, in the orbits we find two openings, both of which are placed upon the inner side of each orbit, called the foramina orbitaria interna anterius et posterius; they merely transmit small branches of nerves and arteries.

Of the course of the superior longitudinal and lateral sinuses.

The superior longitudinal sinus commences by a small vein which emerges at the foramen cœcum, it runs along the spine of the os frontis, and beneath the sagittal suture; it then descends upon the upper half of the perpendicular spine of the occipitis, and finally terminates in one of the lateral sinuses, and generally in the right lateral.

The lateral sinus of either side, commencing from the termination of the superior longitudinal, runs along the transverse ridge of the os occipitis, then upon the posterior and inferior angle of the parietal bone; from this it passes upon the petrous portion of the temporal bone opposite to the mastoid process, and a second time it gets upon the occipital by the side of the foramen magnum, and eventually leaves the skull at the foramen lacerum basis cranii posterius, to form the commencement of the internal jugular vein.

BONES OF THE FACE.

The bones of the face are placed immediately beneath the os frontis, and are grouped together under the common name of upper jaw. They are fourteen in number, and are usually divided into six pairs and two single ones, as follows:

Two ossa nasi,
— unguis,
— maxillaria superiora,
Two ossa malarum,
— palati,
— spongiosa inferiora,

These constitute the six pairs. The two

single bones are, the *vomer* and the *os maxillare inferius.*

All these bones are connected together by various sutures, which are named from their position and course which they take; but they are of no practical utility whatever, and we shall therefore pass over them and proceed to describe the

Ossa Nasi.

These bones are situated in the upper part of the face, between the superior maxillary bones of each side. They are convex externally, to form the bridge of the nose, and concave internally, to increase the cavity of the nostrils. They are of an oblong figure, and are usually contracted in the centre; being expanded above, and still more so below. Their upper edges, where they are connected to the nasal process of the os frontis, are serrated. Their inner edges, where they are opposed to each other, are flattened. Below they terminate in a thin edge by which they are connected to the cartilage of the nose. Their outer edges are rather serrated, for connexion with the nasal processes of the superior maxillary bones. Projecting from the inner edge of each bone, where they are opposed to each other there is a ridge called the spinous process, which is connected with the nasal lamella of the æthmoid bone, to assist in the formation of the septum narium.

Os Unguis, vel Os Lachrymale.

Of either side, is a small flat quadrangular shaped bone, placed at the inner and fore-part of each orbit, just beneath the internal angular process of the os frontis, and behind the nasal process of the superior maxillary bone. Its external surface is divided into two unequal portions by means of an oblique ridge. The outermost, or anterior of these portions, is hollowed or grooved. This groove assists in the formation of the lachrymal fossa, in which the lachrymal sac is received. The posterior, or innermost portion, is smooth, in order to form a part of the inner side of the orbit. The internal surface is concave, covering a part of the æthmoidal cells. Superiorly, the bone has a rough and rather serrated edge, by which it is connected with the internal angular process of the os frontis; behind, it is opposed to the os planum of the æthmoid bone; and in front it is connected with the nasal process of the superior maxillary bone.

It is this bone which is pierced in the operation for fistula lachrymalis. An operation which is easily performed, care being taken to carry the point of the probe in the direction of the groove and nasal duct.

Os Maxillare Superius

Is of large size, and very irregular shape. From the upper and inner part of it, the nasal process ascends, terminating superiorly in a serrated edge, to be connected to the internal angular process of the os frontis. Behind, and to the outer side of the nasal process, there is a groove which assists in the formation of the lachrymal sac. This groove is afterwards coutinued behind the nasal process into the inferior chamber of the nose, and assists in forming the nasal canal, through which the nasal duct passes. To the outer side, and behind the nasal process, the orbitar process is situated, forming a large portion of the floor of the orbit. Uudemeath this process, we find the canalis suborbitarius, which terminates anteriorly, at the foramen infra orbitarium. This opening is placed from a quarter to half an inch below the orbit, the canal and opening transmit the infra orbitar blood-vessels and nerve. The space between the orbitar and nasal processes is occupied by the os unguis. Below, and to the outer side of the orbitar process, there is a rough surface, connecting it to the os male. The fore part of the body of the bone is hollowed, giving attachment to the muscles of the face, whilst the back part is convex and round; and this roundness and convexity forms the tuberosity. Inferiorly, the bone is lengthened by the alveola processes. These form the acetabula dentia, the sockets receiving the teeth. Upon the inferior part of the bone the palatine process is situated. This is hollowed above and below, The inferior part passes in an arched direction, upwards and backwards, and forms a part of the floor of the nostrils and roof of the mouth. Upon the fore part of the bone, and just where it is joined to the same bone of the opposite side, there is a small depression, which assists in forming the foramen incisivum. On the inner side there is a rough surface for connexion with its fellow; and upon this rough surface superiorly, there is a small kind of spinous edge, which assists in forming the septum narium. Upon the inner side of the nasal process there is a small ridge, to which the inferior spongy bone is attached. If we examine the bone internally, we shall find that the body is occupied by a cavity, which is named from its first describer antrum Highmorianum, or Antrum of Highmore. This cavity is concave towards the cheek, but flat towards the nose, and is separated from the nostril by a very thin plate of bone; in the macerated bone it appears to have a large opening, but in the recent subject this is far from being the case, as it is almost wholly filled up by ligament, a very small opening only being left just at the top of the cavity. Very frequently it is attacked with acute inflammation, suppuration follows, and it becomes distended with pus; the cheek swells, the face becomes much deformed, the sufferings are exceedingly severe, and if the pus be not evacuated caries of the bone takes place, and the matter makes its exit by ulcerating the cheek, or sometimes by the sides of the teeth. In an acute attack the diagnosis is generally clear, and these dreadful effects may be averted by extracting the second or third molar teeth, and perforating the bone by a probe or trocar. Where the inflammation is chronic, it may go on for a long time unobserved, the patient merely complaining of toothache, and the integuments of the cheek remaining free from discolouration or swelling.

Os Male,

Of either side is an irregular shaped bone, the lower and fore part is somewhat of a square form; it is convex in front and a little concave behind. Its convexity forms the prominent part of the cheek. Its concavity a part of the temporal fossa under which the temporal muscle passes. This bone has three considerable processes, *viz.* an orbitar, maxillary, and a zygomatic process. The orbitar process is placed upon the upper and fore part, and it forms a large portion of the outer part of the orbit, and it is also connected to the external angular process of the os frontis. The maxillary process is placed upon the inner and lower part, and is connected to the outer part of the superior maxillary bone. Behind, the zygomatic process is situated, by which it is connected with the zygomatic process of the os temporis, and thus by the union of the two processes, the zygomatic arch is formed.

Os Palati,

Of each side, is an irregular shaped bone placed behind the palatine process of the superior maxillary bone, between it and the pterygoid processes of the sphenoid. Upon the lower part we find the palatine process. This on the fore part has a rough surface connecting it to the back part of the palatine process of the superior maxillary bone. It has also another rough surface upon its inner side, connecting it to its fellow. This process uniting with that of the superior maxillary bone, forms the floor of the nostrils and roof of the mouth. By the union of the two palate bones there is a small ridge found, which assists in forming the septum narium. Proceeding backwards and outwards from the palatine process, we find the pterygoid process, which is received between the external and internal pterygoid plates of the sphenoid bone. Between the palatine process of the palate bone, and the same process of the superior maxillary bone, the foramen palatinum posterius is situated, and behind this there is another small opening in the palate bone itself. Ascending from the outer side of the palatine process, we find the nasal process, and upon the inner side of this process there is a small ridge which supports in part the inferior spongy bone. The nasal process ascends upon the inner side of the tuberosity of the upper jaw, and closes a portion of the opening from the antrum. It has a rough surface, externally, connecting it to the tuberosity of the upper jaw and pterygoid process of the sphenoid bone. Superiorly it terminates in the orbitar process, which forms a small portion of the back part of the orbit. This process is hollowed, and communicates with the æthmoidal cells. Between the orbitar process and root of the pterygoid process of the sphenoid bone, we find an opening called the foramen spheno palatinum, leading into the nostrils; it transmits the spheno palatine artery and nerve which is given off from the second division of the fifth pair of nerves.

Ossa Spongiosa Inferiora.

Each bone is of a spongy structure (hence its name), it hangs curled up in the nose, and it is attached to the inner side of the nasal processes of the superior maxillary and palate bones; it closes a considerable portion of the opening from the antrum. Above and upon the inner side, where it is opposed to the septum narium, it is irregularly convex, whilst the outer part is considerably hollowed. The inner part is turbinated or twisted.

This completes the description of the six pairs, and we shall now commence that of the vomer and os maxillare inferius.

The Vomer,

Is so named from its resemblance to a ploughshare. Upon the upper and back part there is a depression which receives the processus azygos of the sphenoid bone; it is also connected superiorly, to the nasal lamella of the æthmoid bone. Inferiorly it is connected to the palatine processes of the superior maxillary and palate bones. Anteriorly it is united by a rough edge to the middle cartilage of the nose. The posterior edge is turned towards the cavity of the fauces, and is unconnected with any other bone.

Os Maxillare Inferius.

The lower jaw has been compared in figure to a horseshoe, but more correctly the Greek υ upsilon. In the fœtus it is divided into two parts, which are afterwards united in the centre, forming the symphisis, or the chin. Proceeding outwards and backwards from the symphisis, upon each side is seen the base, and the termination of the base forms the angle. Superiorly the bone is lengthened by the alveolary processes, which correspond to those of the upper jaw, forming the acetabula dentia, the sockets for the teeth. About three quarters of an inch to the outer side of the symphisis, but upon each side, of the centre, the foramen mentale is situated, which is the anterior termination of the inferior maxillary canal. Passing upwards and backwards from the angles, we find the ascending plates; each plate terminates superiorly in two processes, the anterior of which is called the coronoid, and the posterior the condyloid. The coronoid terminates in a pointed extremity, and upon this the temporal muscle is inserted. Upon the condyloid process we find an oblong articulating surface, which is received into the glenoid cavity of the os temporis. Upon the inner side of the ascending plate there is a large opening which is called the foramen maxillare posterius, or the posterior opening of the inferior maxillary canal, transmitting the inferior maxillary blood-vessels and nerve. This opening leads into a canal which runs throughout the whole extent of the bone, and terminates anteriorly at the foramen mentale. If the bone be carefully examined, a groove will be found which is made by the vessels previously to their entering the opening. The angles of the bone internally are rough, receiving the insertions of the pterygoid muscles. The outer part of each angle is also rough, receiving the insertion of the masseter muscle. Opposite to the symphisis internally, there is a small tubercle, which gives origin to the genio hyoideus and genio hyoglossus muscles. We also find an oblique ridge extending from this tubercle to near the last molar tooth, which gives origin to the mylo hyoideus. The lower jaw is connected to the glenoid cavities of the ossa temporum by means of its inter-articular cartilages. Its motions are upwards and downwards, a considerable degree of lateral or grinding motion is also permitted, and it may be carried some way beyond the upper.

Having now described the bones of the face, we shall proceed to the formation of the orbits.

The Orbits

Are two large funnel-like cavities, situated just beneath the os frontis, having their bases in front, and their apices behind. They are composed of seven bones, which are as follow; os frontis, os sphenoides, and os æthmoides, these three bones of the cranium are common to both orbits.

Then there are four of the face which are proper to each orbit, *viz.* os unguis, os maxillare superius, os male, and os palati. The upper part of each orbit is formed by the os frontis, the lower part by the os maxillare superius. The inner part, partly by the os unguis and os planum of the æthmoid bone; the outer part by the os male and os sphenoides; the back part, in part by the os planum of the æthmoid and by the os palati. The os frontis forms the largest, and the os palati the least part of each orbit.

Openings into the orbits.

On the inner side of each orbit we find the foramina orbitaria interna anterius et posterius; at the back part, the foramina optica, and to the outer side of these the foramina lacera orbitalia superiora. At the lower and outer part of each orbit we find the fissura spheno maxillaris, so called from its being placed between the sphenoid and superior maxillary bones. Underneath the orbit the canalis sub-orbitarius is situated, which terminates anteriorly at the foramen infra orbitarium. At the upper part we find the foramen supra orbitarium, and to the inner side of this, a groove, which transmits the tendon of the superior oblique muscle of the eye. In front of the pterygoid process of the sphenoid bone, and behind the tuberosity of the upper jaw, the foramen rotundum is situated. Leading downwards from this foramen we find the palato maxillary canal. This canal terminates inferiorly at the foramen palatinum posterius. It transmits the palato maxillary vessels and nerves.

10.

Formation of the Nose and its cavities.

The nose is formed partly of bone and partly of cartilage. It is divided into two cavities by means of the septum narium. This septum is formed by the vomer, nasal lamella of the æthmoid bone, assisted by the spines of the ossa nasi, palate, and superior maxillary bones, and also by the processus azygos of the sphenoid. It is completed by five cartilages. The first completes the septum narium anteriorly. Two others form the apex, and the sides are completed by the alæ nasi.

The floor of the nostrils is formed by the palatine processes of the superior maxillary and palate bones. The roof anteriorly by the ossa nasi, os frontis, and nasal processes of the superior maxillary bones, and posteriorly by the sphenoid and æthmoid bone. The parietes are formed by the ossa nasi and nasal processes of the superior maxillary bones, also by the os unguis and os planum of the æthmoid upon each side. In the cavities of the nostrils we find four bones, *viz.* two ossa spongiosa, superiora and inferiora. These four bones divide each nostril into three distinct chambers, *viz.* a superior, middle, and inferior. The superior chamber is placed between the roof of the nostril and superior spongy bone; the middle chamber, between the spongy bones themselves; and the inferior between the inferior spongy bone and the roof of the mouth. Into each superior chamber there is an opening from the sphenoidal sinuses, and from the posterior æthmoidal cells, and partly also from the frontal sinuses. Into the middle chamber there is an opening from the frontal sinuses, and from the antrum. The anterior æthmoidal cells, communicating with the frontal, may be also said to open into this chamber. Into the inferior chamber there is an opening from the nasal duct, and also another on the fore part from the foramen incisivum, or foramen palatinum anterius, as it is also called. The nose is lined in all its cavities by a very delicate secreting membrane called the membrana pituitaria. It extends into the different sinuses and cells of the frontal sphenoid, and æthmoid bones. It secretes the mucus of the nose and upon it the filaments of the first pair of nerves conveying the sense of smell are expanded.

FINIS.

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